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REMEDIAL INVESTIGATION REPORT

FOR

USATHAMA - RATSS
LAKE CITY ARMY AMMUNITION PLANT
INDEPENDENCE, MISSOURI

VOLUME II

DAAA15-85-D 0015

Work Order No. 2281-09-07

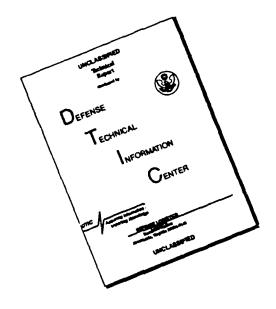
Prepared By

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June 1990

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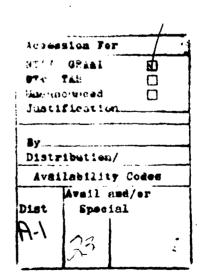
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Statement A per telecon Denise Hancsak USATHAMA/CETHA-IR-A Aberdeen Proving Ground, MD 21010-5401

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APPENDIX A WELL DEVELOPMENT INFORMATION

WELL DEVELOPMENT INFORMATION

Method	bailed	ailed	ailed	ailed	bailed	ailed	ailed	pedunc	pedunc	pedunc	belled	bailed	bailed	bailed	bailed	Delled	belied	bailed	pedund	pedund	pedund	pedunc	pedund	
	~	~	~	_	_	_	_				_		_	_	_	_	_				_	_	_	
Maa	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	clear	clear	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	cloudy	clear	cloudy	clear	clear	clear	
TWR		118 gal			45 gal												60 gal							
aya	2/22-1 hr	2/22-1 hr	2/22-2.5 hr	2/23-1hr	2/23-1hr	2/23-1.5 hr	2/23-2 hr	2/19-5hr	2/2-45 min	2/20-35 min	2/20-2 hr	2/21-1.5 hr	2/21-2.5 hr	2/21-1.5 hr	2/22-1.5 hr	2/22-1 hr	2/22-1 hr	2/23-1 hr	2/24-2 hr	2/24-5 hr	2/21-2 hr	2/21-2 hr	2/21-2 hr	
WLAD	16'	29.	24.	26'	24.5	391	331	13'	13'	11,	5	16.5	11,	10.5	56 1	16'	20.	25	12,	56	i	1	!	
WLBD	11,		12.	25,	24.	27'	28 '	13,	13'	13,	.9	10,	•	•	191	11,	18,	25	7:	14,	12.8	24.2	15.2	
Total <u>Depth</u>	25'	29.	36'	34.	321	391	43.	31,	06	85.	17.	221	31,	191	28.	231	281	35.	231	31,	85.51	50.5	81,	
Well #	14-3	2-8	5-7	12-5	7-13	8-7	8-8	16-6	16-7	17-8	17-7	16-8	17-10	17-9	14-1	16-11	7-11	9-8	16-13	16-12	18-7	16-9	14-4	

WELL DEVELOPMENT INFORMATION (Continued)

Method	pedwnd pedwnd pedwnd pedwnd pedwnd
MOO	clear cloudy clear clear clear
TWR	360 gal 85 gal 350 gal 360 gal 400 gal
aya	2/21-1 hr 2/22-1.5 hr 2/22-1.5 hr 2/22-1 hr 2/22-1.5 hr
MLAD	11111
MEBD	22.3.
Total Depth	6 6 8 N 6 8 N 6 8 N 6 8 N 6 8 N 6 8 N 6 N 6
Well 4	12-6 14-2 3-8 7-12 16-10

WLBD - Water level before development WLAD - Water level after development D & D - Date and duration of development TWR - Total water removed DDW - Description of development water

APPENDIX B MONITORING WELLS AND STAFF GAUGING ELEVATIONS

TABLE B-1 Summary of Ditch Water Elevations All Values Recorded at MSL

1 June 1988

Staff Gauge	Gauge Elevation	Surface Water Elevation
1	758.89	755.6
2	768.72	764.85
3	732.99	740.14
4	738.67	735.12
5	738.87	
6	734.65	
7	732.65	729.15
8	737.05	733.4
9	740.24	
10	742.22	740.28
11	742.13	

Locations of Staff Guages are shown in Figure 3-3

TABLE 8-2 Summary of Groundwater Elevations All Values Recorded at Feet Above MSL 1 June 1988

Monitoring Well	Ground Elevation	Top of PVC Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Groundwater Elevation
	77/ 0	776.78	760	755	772.28
1-1	774.9		756	746	760.61
1-2	763.53 762	765.15 763.16	738 728	718	759.16
1-3			764	747	762.72
1-4	772.72 784.2	775.35 786.47	778	764	778.81
1-5	762.6	764.69	739	726	758.51
1-6	796.08	797.83	773	743	781.31
1-7	790.00	197.03	769	739	
1-7A	763.2	764.95	744	729	758.67
1-8	761.7	764.2	748	733	756.44
1-9	765.2	765.99	745	730	759.34
1-10 2-1	756	757.35	730	720	752.4
_	756 764	766.54	724	714	753.03
2-2 2-3	762.3	762.5	735	730	757.12
2-3	762.1	764.45	730	725	757.67
2-4	759.4	761.95	744	729	742.76
2-6	73714		748	733	
2-7	756.2	758.23	744	729	749.34
2-8	763.6	766.19	744	734	••
2-0 3-1	742.6	743.69	697	692	723.55
3-2	743.0	744.57	723	708	723.77
3-3	742.3	743.92	722	717	725.58
3-3 3-4	742.9	744.49	700	695	723
3-5	745.5	746.07	725	710	723.47
3-6	744.7	746.64	722	712	723.69
3-6 3-7	741.7	743.86	724	714	724.22
3-8	742.7	744.8	670	660	723.77
4-1	762.92	764.01	741	726	740.04
4-2	757.17	758.38	731	717	745.80
4-3	759.66	760.8	724	719	732.12
4-4	763.24	764.34	736	731	746.30
4-5	764.2	765.78	743	738	<i>7</i> 57.41
4-6	777.74	777.74	743	728	770.42
5-1	752.25	753.79	722	717	736.63
5-2	754.22	755.49	730	725	<i>7</i> 38.81
5.3	755.36	756.5	718	713	<i>7</i> 35.59
5-4	754.17	755.44	722	717	742.24
5-5	751.2	753.34	734	724	741.47
5-6	759.2	761.66	742	732	745.54
5-7	773.1	775.75	747	737	763.05
6-1	775.33	777.31	755	750	766.93
6-2	788.37	790.16	764	759	76 9 .25
6-3	788.08	789.32	769	764	785.60
6-4	781.05	782.59	768	758	776.49
6-5	779	781.48	748	733	763. <i>7</i> 3
6-6	779.22		756	741	765.77
6-7	799.47	800.75	790	775	791.09
7-1	747.8	748.91	723	708	725.47
7-2	747.5	748.82	729	709	729.22
7-3	744.1	745.68	719	704	739.60
7-4	742.1	743.84	717	712	725.52
7-5	748.1	749.35	728	708	725.69

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TABLE 8-2 (Cont.) Summary of Groundwater Elevations All Values Recorded at Feet Above MSL 1 June 1988

7-6 745.5 746.84 712 717 725.51 7-7 741.8 743.82 724 714 725.20 7-8 742.8 745.12 726 716 725.01 7-9 745.8 748.08 728 718 726.22 7-10 743.9 746.2 727 717 725.41 7-11 741.56 743.55 726 716 724.97 7-12 741.6 744.03 669 659 722.00 7-13 746.8 749.45 725 715 725.41 7-11 821.37 822.58	lonitoring Well	Ground <u>Elevation</u>	Top of <u>PVC Elevation</u>	Top of Screen Elevation	Sottom of Screen Elevation	Groundwater Elevation
7-7	7-6	745.5	746.84	712	717	725.51
7-9 7.5.18 745.08 728 718 726.22 7.7.10 743.9 746.2 727 717 725.41 77.11 741.56 743.55 726 716 726 717 725.41 77.12 741.6 743.55 726 716 726 717 725.41 77.12 741.6 744.03 669 659 722.60 7.13 746.8 749.45 725 715 725.46 MM-1 821.37 822.58 789.77 MM-1 821.37 822.58 789.77 MM-2 811.17 812.21 789.44 MM-3 780.05 781.2 789.44 MM-4 766.28 767.51 779.94 MM-4 766.28 767.51 779.94 MM-5 820.76 804.84 779.98 MM-4 766.28 767.51 7794.09 8-1 7794.09 8-2 753.42 755.96 743 713 733.48 8-4 762.06 764.28 755.96 743 713 733.48 8-4 762.06 764.28 755.96 743 713 733.48 8-4 762.06 764.28 755.96 743 713 733.48 8-5 783.86 785.81 772 756 770.27 8.88 8-5 783.86 785.81 772 756 770.27 8.88 8-5 783.86 785.81 772 756 770.27 9.58 8-7 750.7 753.14 722 712 725.87 9-1 740.16 741.29 728 701 728.25 9-1 740.16 741.29 728 701 728.25 9-1 740.16 741.29 728 701 728.25 9-1 740.16 741.29 728 701 728.25 701 728.27 9-3 739.46 740.86 706 701 728.69 9-4 743.16 744.67 729 701 728.60 9-4 743.16 744.67 729 701 728.60 9-4 743.16 744.67 729 701 728.60 9-4 743.16 744.67 729 701 728.60 821.10 9-1 740.16 741.29 728 811 806 832.51 808 818.48 10-5 830.28 832.13 830.8 818.48 10-5 830.28 832.13 830.8 818.48 10-5 830.28 832.13 820 815 817.73 10-6 854.73 856.49 821 806 832.51 10-6 854.73 856.49 821 826.26 821 830.72 830.72 830.72 830.72 830.72 830.72 830.72 830.72 830.72 83			743.82	724	714	725.29
7-10 743.9 746.2 727 717 725.41 7-11 741.56 743.55 726 716 724.97 7-12 741.6 744.03 669 659 722.60 7-13 746.8 749.45 725 715 725.46 MM-1 821.37 822.58 789.77 MM-2 811.17 812.21 789.44 MM-3 780.05 781.2 789.44 MM-4 766.28 767.51 769.43 MM-4 766.28 767.51 794.09 8-1 751.26 750.51 726 711 732.04 8-2 753.42 755.96 743 730 715 723.48 8-4 762.06 764.28 750.7 730 715 723.48 8-4 762.06 764.28 750.7 730 720 729.88 8-5 783.86 785.81 772 756 770.27 8-6 751.84 754.57 730 720 729.88 8-7 750.7 753.14 722 718 708 725 725 725 725 725 725 725 725 725 725	7-8		745.12	726	716	725.01
7-11 741.56 744.03 669 659 722.09 7-12 741.6 744.03 669 659 722.09 7-13 746.8 749.45 725 715 725 715 725.46 MM-1 821.37 822.58	7-9		748.08	728	718	726.22
7-12 741.6 744.03 669 659 722.60 7-13 746.8 749.45 775 775 7715 772.40 1-13 746.8 749.45 775 775 7715 772.40 1-14 821.37 822.58	7-10	743.9	746.2	727		725.41
7-13 746.8 729.45 725 715 725.46 MH-1 821.37 822.58 789.77 MH-2 811.17 812.21 789.44 MH-3 780.05 781.2 789.44 MH-4 766.28 767.51 759.44 MH-5 820.76 804.84 759.44 MH-5 820.76 804.84 759.48 MH-5 820.76 804.84 759.48 8-1 751.26 750.51 726 711 732.04 8-2 753.42 755.96 743 713 733.48 8-3 752.56 751.83 730 715 743.48 8-3 752.56 751.83 730 715 743.48 8-4 762.06 764.28 750 742 748.88 8-5 783.86 785.81 772 756 770.27 8-6 751.67 754.02 718 708 720 729.58 8-7 750.7 753.14 722 712 725.67 8-8 751.67 754.02 718 708 725.71 9-1 740.16 741.29 728 701 726.07 9-2 740.56 761.62 706 701 726.07 9-3 739.46 740.86 706 701 726.07 9-4 743.16 744.67 729 701 729.67 10-1 855.72 856.9 842 837 10-2 854.41 854.99 826 821 830.72 10-2 854.41 854.99 826 821 830.72 10-3 834.43 837.61 817 812 828.26 10-4 842.78 843.88 813 808 818.48 10-5 830.28 832.13 820 815 817.73 11-1 790 791.3 771 766 782.71 11-3 806.82 808.72 783 778 778 790.45 11-1 770.89 792.12 772 767 778 770 786.40 12-1	7-11	741.56	743.55	726		
Mu-1 821.37 822.58 789.47 Mu-2 811.17 812.21 766.28 Mu-3 780.05 781.2 768.33 Mu-4 766.28 767.51 759.84 Mu-5 820.76 804.84 779.69 8-1 751.26 750.51 726 711 732.04 8-2 753.42 755.96 743 713 733.48 8-3 752.56 751.83 730 715 743.48 8-4 762.06 764.28 750 712 748.88 8-5 753.86 785.81 772 756 770.27 8-6 751.84 754.57 730 720 729.58 8-7 750.7 753.14 722 712 725.87 8-8 751.67 754.02 718 708 708 725.71 9-1 740.16 741.29 728 701 728.22 9-2 740.56 740.86 706 701 728.07 9-3 739.46 740.86 706 701 728.07 10-1 855.72 856.9 842 837 838.7 838.7 10-2 854.41 854.99 826 821 830.72 10-3 836.43 837.61 817 812 828.26 10-4 842.78 843.88 813 808 818.48 10-5 830.28 832.13 820 815 817.73 10-6 854.73 856.49 821 806 832.53 11-1 790.89 792.12 772 775 777 778.40 11-1 790.89 792.12 777 776 777 778.40 11-1 790.89 792.12 777 777 777 778.40 11-2 790.89 792.12 777 777 777 778.40 11-3 806.82 808.72 783 778 779 779 772.72 11-1 770.89 791.3 771 776 782.71 12-5 742.3 744.49 725 777 777 778.40 11-4 794.15 795.15 775 770 778.40 11-2 790.89 792.12 777 770 778.40 11-3 775.83 778 7790.45 11-4 794.15 795.15 775 770 778.40 11-2 770.89 792.12 772 767 778.77 11-1 755 744.49 725 777 777 778.40 11-1 775 775.83 777 778 779 779 779 772.57 11-1 775 775 775 775 777 778.40 11-2 770.89 792.12 772 767 778.77 11-1 750 779.37 775 775 775 775 775 775 775 775 775 7	7-12	741.6	744.03			
Mu-2 811.17 812.21 789.44 Mu-3 780.05 781.2 799.84 Mu-4 766.28 767.51 799.84 Mu-5 820.76 804.84 794.09 8-1 751.26 750.51 726 711 732.04 8-2 753.42 755.96 743 713 733.48 8-3 752.56 751.83 730 715 742 748.88 8-6 752.56 754.28 750 742 748.88 8-5 783.86 785.81 772 756 770.27 8-8 7 750.7 753.14 722 712 756 770.27 8-8 8 751.67 754.02 718 708 720 729.58 8-7 750.7 753.14 722 712 725.87 8-8 751.67 754.02 718 708 720 729.58 8-7 750.7 753.14 722 712 725.87 8-8 751.67 754.02 718 708 720 729.58 8-7 750.7 754.02 718 708 720 729.58 8-7 750.7 754.02 718 708 720 729.58 8-7 750.7 754.02 718 708 720 729.58 8-7 750.7 754.02 718 708 720 729.58 8-8 751.67 754.02 718 708 722 712 725.87 8-9 750.7 754.02 706 701 728.66 9-4 743.16 744.67 729 701 728.66 9-4 743.16 744.67 729 701 729.67 10-2 854.41 854.99 826 821 830.72 10-3 836.43 837.61 817 812 828.26 10-4 842.78 843.88 813 808 818.48 10-5 830.28 832.13 820 815 817.73 10-6 854.73 856.49 821 806 832.53 11-1 790 791.3 771 766 782.71 11-2 790.89 792.12 772 767 782.71 11-2 790.89 792.12 772 767 782.71 11-3 806.82 808.72 783 778 790.45 11-4 794.15 795.15 775 770 786.40 11-2 794.15 795.15 775 770 786.40 11-2 735.83 737.78 723 711 726.74 14-2 735.83 737.78 723 711 721 726.74 14-1 745 746.93 727 727 717 726.74 14-2 735.83 737.78 723 711 721 736.84 14-4 736.13 738.6 667 657 723.96 14-4 735.33 737.78 725 731 731 721 736.84 16-5 761.6 763.04 738 739 729 754.39 16-6 738.3 740.43 719 709 728.66	7-13	746.8	749.45	725		
Ha-3 780.05 781.2 768.53 Ha-4 766.28 767.51 759.84 Ha-5 820.76 804.84 779.86 711 732.04 Fabruary Fabru	MW-1	821.37		••		
Mu-5 820.76 804.84 794.09 8-1 751.26 750.51 726 711 732.04 8-2 753.42 755.96 743 713 733.48 8-3 752.56 751.83 730 715 733.48 8-4 762.06 764.28 750 715 72 756 770.27 8-8-6 751.84 754.57 730 720 720 729.58 8-6 751.84 754.57 730 720 720 729.58 8-7 750.7 753.14 722 712 756 770.27 8-8 8-8 751.67 754.02 718 708 725.71 9-1 740.16 741.29 728 701 728.22 9-2 740.56 741.62 706 701 728.62 9-4 743.16 744.67 729 701 729.67 10-1 855.72 856.99 842 837 838.77 10-2 854.41 856.99 842 837 838.77 10-2 854.41 856.99 826 821 830.72 10-3 836.43 837.61 817 812 828.26 10-4 842.78 843.88 813 808 818.48 10-5 830.28 832.13 820 815 817.73 11-1 790.89 791.13 771 766 785.04 11-2 790.89 791.15 775 770 778.40 11-3 806.82 808.72 783 770 770 770 778.40 11-4 794.15 795.15 775 770 778.44 11-4 794.15 795.15 775 770 778.44 11-4 794.15 795.15 775 770 778.44 11-4 794.15 795.15 775 770 778.40 11-2 778.80 792.72 770 778.40 11-4 779.15 775.15 775 770 778.40 11-4 779.15 775.15 775 770 778.40 11-4 779.15 775.15 775 770 778.40 11-4 779.15 775.15 775 770 778.40 11-4 774.15 775.15 775 770 778.40 11-4 775.33 745.26 667 657 723.96 14-4 733.3 745.30 726 716 726.83 12-5 744.2 748.22 722 712 724.06 14-2 735.83 737.78 725 725 715 724.06 14-4 735.13 736.6 667 657 723.96 14-4 735.13 736.6 667 657 723.96 14-4 735.33 737.78 725 725 715 725.00 14-6 735.26 764.99 731 731 726.74 14-2 735.83 737.78 725 725 715 725.96 14-6 735.26 764.99 731 731 726.74 14-1 750.01 799 699 727.73	MW-2	811.17				
Mu-5 820.76 804.84 794.09 8-1 751.26 750.51 726 711 732.04 8-2 753.42 750.59 743 713 733.48 8-3 752.56 751.83 730 715 742 748.88 8-4 762.06 764.28 750 742 748.88 8-5 783.86 785.81 772 756 770.27 8-6 751.84 754.57 730 720 720 729.58 8-6 751.84 754.57 730 720 729.58 8-7 750.7 753.14 722 712 725.87 8-8 751.67 755.10 741.29 728 701 728.22 9-2 740.56 741.62 706 701 728.62 9-2 740.56 741.62 706 701 728.60 9-3 739.46 740.86 706 701 728.60 9-4 743.16 744.67 729 701 729.67 10-1 855.72 856.9 842 837 10-2 854.41 854.99 826 821 830.72 10-3 836.43 837.61 817 812 828.26 10-4 842.78 843.88 813 808 818.48 10-5 830.28 832.13 820 815 817.73 10-6 854.73 856.49 821 806 732.11 11-2 790.89 792.12 772 767 782.71 11-3 806.82 808.72 783 771 766 775.01 11-1 790 791.3 771 766 785.01 11-2 790.89 792.12 772 767 782.71 11-3 806.82 808.72 783 778 790.49 11-4 794.15 795.15 775 770 786.40 12-1 742.5 744.49 725 715 770 786.40 12-1 745.5 746.93 772 773 774.44 12-1 750.01 795.5 775 770 786.40 12-1 745.5 746.93 777 779 770 786.40 12-1 755.83 745.50 667 657 723.96 14-1 745 746.93 777 772 777 770 786.40 14-2 755.83 737.78 725.77 770 776.40 14-3 735.33 737.78 725 770 776.77 16-1 855.77 857.93 828 818 832.66 16-5 761.6 763.04 738 779 779 774.13 775.00 16-6 753.53 740.43 779 779 779 779 774.15 16-7 738.3 740.43 779 779 779 779 774.81	MW-3	780.05				
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12-5 746.2 748.22 722 712 724.06 12-6 743.3 745.26 667 657 723.96 14-1 745 746.93 727 717 726.74 14-2 735.83 737.78 723 713 725.00 14-3 735.33 737.78 725 715 724.96 14-4 736.13 738.6 667 657 724.82 16-1 855.7 857.93 828 818 832.66 16-2 762.6 764.38 739 729 754.39 16-3 765 766.56 741 731 755.26 16-4 763 764.91 731 721 754.81 16-5 761.6 763.04 738 728 749.96 16-6 738.26 740.27 659 649 726.84 16-7 738.3 740.43 719 709 728.06 16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
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14-1 745 746.93 727 717 726.74 14-2 735.83 737.78 723 713 725.00 14-3 735.33 737.78 725 715 724.96 14-4 736.13 738.6 667 657 724.82 16-1 855.7 857.93 828 818 832.66 16-2 762.6 764.38 739 729 754.39 16-3 765 766.56 741 731 755.26 16-4 763 764.91 731 721 754.81 16-5 761.6 763.04 738 728 749.96 16-6 738.26 740.27 659 649 726.84 16-7 738.3 740.43 719 709 728.06 16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
14-2 735.83 737.78 723 713 725.00 14-3 735.33 737.78 725 715 724.96 14-4 736.13 738.6 667 657 724.82 16-1 855.7 857.93 828 818 832.66 16-2 762.6 764.38 739 729 754.39 16-3 765 766.56 741 731 755.26 16-4 763 764.91 731 721 754.81 16-5 761.6 763.04 738 728 749.96 16-6 738.26 740.27 659 649 726.84 16-7 738.3 740.43 719 709 728.06 16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
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16-4 763 764.91 731 721 754.81 16-5 761.6 763.04 738 728 749.96 16-6 738.26 740.27 659 649 726.84 16-7 738.3 740.43 719 709 728.06 16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
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16-7 738.3 740.43 719 709 728.06 16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
16-8 747.1 749.94 735 725 737.38 16-9 747.1 750.01 709 699 727.73						
16-9 747.1 750.01 709 699 727.73						
16-10 7A2 7 7A5 45 710 700 750 50						
	16-10	762.7	765.45	<i>7</i> 10	700	750.59
16-11 762.9 765.06 712 702 721.91	16-11	762.9	765.06	712	702	721.91

TABLE 8-2 (Cont.)
Summery of Groundwater Elevations
All Values Recorded at Feet Above MSL
1 June 1988

Monitoring Well	Ground Elevation	Top of PVC Elevation	Top of <u>Screen Elevation</u>	Bottom of <u>Screen Elevation</u>	Groundwater Elevation
16-12	773.8	776.17	753	743	762.02
16-13	773.38	775.4	766	756	767.57
17-1	838.59	842.42	779	754	808.87
17-2	821.29	824.91	766	741	799.10
17-3	776.42	780.04	712	687	763.75
17-4	782.32	785.82	710	685	774.54
17-5	785.2	787.66	773	763	778.51
17-6	788.2	790.46	771	761	760.57
17-7	746.1	748.6	730	720	736.69
17-8	745.4	748.14	662	652	737.47
17-9	737.45	740.05	736	726	732.82
17-10	737.45	740.04	728	718	720.07
18-1	738.2	740.30	726	716	727.03
18-2	737.5	739.73	725	715	<i>7</i> 31.17
18-3	740.12	738.0	728	· 718	729.01
18-4	739.2	741.51	727	717	<i>7</i> 27.23
18-5	739.9	741.96	727	717	<i>7</i> 27.55
18-6	736.5	738.59	724	714	726.67
18-7	737.4	739.26	654	644	726.85

Note: Some of the screen depths have been estimated from boring logs.

APPENDIX C GEOLOGIC DRILL LOGS

TABLE C-1 SUMMARY OF NEW (1988) WELL CONSTRUCTION DATA

MUMBER	SURFACE ELEVATION	RISER ELEVATION	TOTAL DEPTH	HOLE ELEVATION	SCREEN SCREEN ELEVATION	SCREEN SCREEN ELEVATION	SCREEN	SAND
2-8	763.6	766.19	59.0	704.6	734.6	744.6	01	746.6
3-B	142.7	744.8	82.0	660.7	660.7	670.7	2	675.2
2-1	773.1	775.75	50.0	723.1	737.1	747.1	9	751.4
7-11	741.56	743.55	26.0	715.56	715.56	725.56	2	727.56
7-12	741.6	741.6	83. 0	658.6	659.1	669.1	2	673.6
7-13	746.8	749.45	32.0	714.8	714.8	724.8	2	728.3
9-9	751.84	754.57	32.0	719,84	719.84	729.84	2	733.44
8-7	750.7	753.14	9.0	710.7	7111.7	121.7	2	127.2
8-8	751.67	754.02	45.0	706.67	708.67	718.67	9	724.07
12-5	746.2	748.22	34.0	712.2	712.2	122.2	91	728.2
12-6	743.3	745.26	86.5	626.8	656.8	8.993	2	671.7
1-1	745.0	746.93	34.5	710.5	717.0	727.0	2	734.2
14-2	735.83	737.78	23.5	712.33	712.83	722.83	9	725.83
14-3	735.33	737.38	20.2	714.83	715.33	725.33	2	727.33
14-4	736.13	738.60	78.5	657.63	657.63	667.63	2	673.13
9-91	738.26	740.27	30.0	708.26	709.26	719.26	2	720.26
16-7	738.3	740.43	94.0	644.3	649.3	659.3	2	664.3
9-91	747.1	749.94	24.0	723.01	725.1	735.1	으	738.1
16-9	747.1	750.01	50.0	697.1	699.1	709.1	2	714.1
01-91	762.7	765.45	64.0	698.7	700.2	710.2	2	715.2
11-91	762.9	765.06	63.0	6.64.9	701.9	711.9	2	715.9
16-12	173.8	776.17	32.0	741.8	742.8	752.8	2	755.8
16-13	773.38	775.4	20.0	753.38	755.38	765.38	2	767.38
11-1	737.45	740.05	17.5	719.95	720.45	730.45	2	731.45
17-8	737.45	740.05	96.0	651.45	651.95	661.95	2	666.45
17-9	746.1	748.6	20.5	725.6	726.1	736.1	2	738.1
17-10	745.4	748.14	2 B .0	117.4	717.9	727.9	2	760.4
14-7	737.4	739.26	9.0	643.4	643.9	653.9	9	658.4

NOTE: ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL

		OL		IC D			.OG	PROJE		E AND LOCATION LCAAP, NETHOD	Independence, Mo	WELL DIAMETER	PAGE NO. HOLE	-8
STA 2	MT /2/	22	FIN:	3/ 88	DRILL		-Wes	tern	1	B-61/HSA	12"	4" PVC	59.00	
	e i				107	of C	ASTING 1	ELEV.		D ELEVATION	DEPTR/ELEVATION GROU	MOMATER - DATE HEA	SURED	
	R	<u>. B</u>	enne	tt	_	70	56.19		<u> </u>	763.60	26.5	0'/737.10' Drill	ing	
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	WELL		SAMPLE		DESCRIPTION		NOTES	
1	SS	5	3 9 8		-		յմ <u>վ դիկվորկան իրկիրանի</u>			SILTY CLAY:	trace of silt and lignite fi , moist, trace red mottlin	ragments, low ng, medium brown		
2	3 \$	14	4 5 8	760	5-		յի ^ր ինչի ինչկանին երիրիր նումուն			abundant mottli	ing		•	
3	SS	18	4 5 6	•			ֈֈ֍ֈ֍ ֈֈֈֈ֍ֈֈֈֈֈֈֈֈֈֈ	MI.		CLAYEY SILT fragments	: well sorted, abundant o s, moist, abundant mottl	lay, trace of lignite ing, red-brown		
4	SS	18	3 4 6	755	10-		ılılı bir de	MI		same as above				
5	SS	18	3 6 4					MI		some clay, trace	carbonised small nodule	•		
6	55	18	3 4 5	750-	15-			CL			vell sorted, some silt, tra s moderately plastic, moi n			
7	55	18	4 5 .		•			CL		same as above				
8	55	18	4 4 5	745	-			CL		abundant silt				

G	E	OL	OG	IC D	RIL	L L()G	(OJEC)	NAM	E AND LOCATION LCAAP, Independence, Mo.	PAGE NO. 2 of 3	HOLE NO. 2-8
SAMPLE ND.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NO.	res
9	3 3	18	6 6	740-	25-			CL		as above, medium gray		
10	SS	14	8 7 10	735	30-			ML		CLAYEY SILT: well sorted, trace clay, saturated, medium gray, no mottling		
11	SS	16	5 5 7	730	35 -			ML		same as above		
112	5 5	18	\$ 5	725-	40-			ML		same as above		

										MASTER Y		
G	E	Or	OG	IC D	RIL	LL	OG	KOJECT	HAN	LCAAP, Independence, Mo.	PAGE NO. 3 of 3	NOLE NO. 2-8
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAFFLE	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS- IFICATION	SAFPLE	DESCRIPTION	NOT	ES
13	SS	18	6 8	720-	45-			ML		same as above		
14	SS	18	10 12 14	715-	- - 50-			CL		SILTY CLAY: well sorted, trace silt, low plasticity, moist, trace mottling, dark gray	•	
15	SS	1.	40 50 50/1"	710-	- - - -			Sh		SHALE: well sorted, trace silt, friable, moist, dark gray		
16	SS	3	90/5*	705	-			Sh		light gray End of boring @ 59.0 feet		
*A3 38	**************************************	DTSI PLIT	SPOO	ST ST CT	= SHE = COR = CUI	LBY	CS =	CONTIN	NOUS	SAMPLER LCAAP Independence, Mo.	PAGE NO.	HOLE NO. 2-8

		OL		IC D			OG			LCAAP, Independ	eace, Mo.		PAGE NO. NOLE N 1 of 4 3-8
	MT 10	/90	718		DRIL		West				TARETER 7/8°	4" PVC	TOTAL DEPTH
ά		- 55	4/4	20/88	100	जं ट्र	ING EL	EV.	GROUN	ud Rotary 7 7 7 DELEVATION DEPTH/ELEV	ATION GROUN	MATER - DATE HEA	82.50'
	R	<u>. B</u>	<u>esn</u>	tt		74	4.80_			742.70	21.03	3'/721.67' 6/1/	188
DESTRUCTION OF THE PAGE	SAPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS-	SAMPLE	DESCR	IPTION		NOTES
	5 5	8	346	740-	•			CL		SILTY CLAY: well sorted, tr low plasticity, moist, trace m	race silt, roots ottling, medi	s and lignite, um gray	
3	33	10	3 3 5		5-			CL		medium brown			•
3	3 5	18	5 6 9	735-	-			SM		SAND: medium, well sorted, mottling, medium bro lenses of silt, trace cla	wn, moist, wi	urated, trace th some thin	
4	SS	18	7 11 16		10-			SM		finer			
5	55	8	5 4 6	730-				SM		same as above			
8	5 5	0	3 1 1		15-			SM					NO RECOVERY
,	58		2 2 2	725	-			SM		red-brown, saturated			
	55		6 5 7		•			SM		no silt lenses			

G	E	OL	OG	IC D	RIL	LL	OG	ioJI(G)		LCAAP, Independence, Mo.	PAGE NO. 2 of 4	NOLE NO. 3-8
SATE NO.	SAFFLE TYPE	RECOVERY "	SAFFLE		DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	NO	TES
9	33	8	9 8 5	720-	25-		₩.	SM		trace silt, medium gray		
10	33	24	2 4 13	715-	- - 30 -			SM		some lignite fragments		
11	55	18	14 20 26	710-	35 -			SM		interbedded thin lenses of abundant lignite fragments		
12	3 3	10	45 20 30	705	40-			SM		well corted		

								PROJ	ECT NA	WESTER I	PAGE NO.	NOLE MO.
G	E	OL	OG	K D	RIL	LL	OG			LCAAP, Independence, Mo.	3 of 4	3-8
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	BLOUS?		DEPTH	GRAPHIC LOG	MELL	C. A88-	SAPPLE	DESCRIPTION	NO:	TES
13	SS	14	10 10 14	700-	- - 45 -			SI	M	very abundant lignite fragments, sand sise with fine sand, saturated		
14	55	48	23 30 41	695	- - 50-			SI	M.	SAND, fine to medium with trace lignite and fine gravel		
15	53	6	32 36 39	690	- - - 			51	M	trace coarse sand, no lignite		
16	58	13	20 23 19	485	- - - 60 -			33	M	abundant lignite alluvium, sand is medium gray		
17 *A3 \$8	_	112	17 9900	680-	3 M	SV.	G		M TINUCL	poorly sorted, trace silt, medium gravel and thin lignite lenses, medium to dark gray LCAAP Independence, Mo.	PAGE NO.	HOLE NO.

GE	<u> </u>	OG	ic D	RIL		ng	PROJEC	T KAR	AND LOCATION	PAGE NO.	HOLE NO.
<u>GL</u>									LCAAP, Independence, Mo.	4 of 4	3-8
SAMPLE NO.	1 37	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS-	SAMPLE	DESCRIPTION	NO.	res
		38		65 -					see above		
18 55	16	19 18 19	675	- 70			SM		no lignite lenses		
19 55	10	20 16 18	670-	75-			SM		medium to coarse		
20 55	10	14 16 16	665-	80-			SM		fine to coarse, abundant fine to coarse gravel		
				-					LIMESTONE BEDROCK End of boring @ 83.0 feet		٠
ASTR IS = 1	315 PLI	35 1 \$20	CH Ç,	= SHE = COR	LSY	Çş :	CONTI	NOVS	LCAAP Independence, Mo.	PAGE NO.	HOLE NO.

		OL.		IC D			OG	PROJE		E AND LOCATION LCAAP,	Independence, Mo.		PAGE NG. HOLE 1 of 3 5-	7
5TA	XT /5/	••	PIUI	5/88	DRILL		_₩	***	ı	HETHOD B-61/HSA	12"	WELL DIAMETER 4" PVC	TOTAL DEPT	
tot			1 4/.	3/00	100		-Wes	LEV.	GROUN	D ELEVATION	DEPTH/ELEVATION GROU	WHATER - DATE HEA	SURED	
	R	<u>. B</u>	<u>enne</u>	tt	İ	77	5.75		<u> </u>	773.10	12.7	<u>0'/760.40' 6/1/</u>	88	
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	el ev	DEPTH	GRAPHIC LOG	TIEN	CLASS-	SAFLE INTERVAL		DESCRIPTION		NOTES	
1	S \$	4	6 5 5		-					SILTY CLAY: w	rell sorted, trace silt, low tling, red-brown	plasticity, moist,		
2	55	14	7 12 16	770-	5-		أمارا والمراوا والمراوا والمراوا والمراوا والمراوا والمراوا			trace roots, abu	ndant mottling		•	
3	SS	18	5 5	·	· •		en ernernernen e	三		same as above				
4	55	18	4 4 5	765	10-		*****	**************************************		trace lignite				
5	55	18	10 12 14		-			CI		abundant silt as solution o	d lignite, moist brown, s hannels	ome vertical		
6	58	18	10 9 8	760-	15-					same as above				
7	53	18	10 12 13		-			CI		trace lignite	·			
•	58	18	7 10 9	755	-			CI		same as above				
TI IB	THE		100 C	31 30 C	• SHE		CS.	· CONT	1000	SAMPLER	LCAAP Independence,	Ma	PAGE NO. HOLE 1 of 3 5-	

GE	=()L	OG	IC D	RIL	L LOG	ROJECT		LCAAP, Independence, Mo.	PAGE NO. 2 of 3	S-7
I	BULL TIPE	RECOVERY "	SANPLE	ELEV	НТФЗО	GRAPHIC LOS WELL CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	мо	TES
9 3	3	18	5 7 8	750-	25-		CL		no lignite, trace silt saturated at 26.0 feet during drilling		
10 \$	3	18	9 11 13	745	- - 30 -		CL		trace coarse sand, fine gravel, lignite alluvium		
11 \$	3	18	12 13 14	740-	35 -		CL		abundant silt		
12 \$	\$	18	18 13 16	735-	- - 40 -		CL		same as above		

										WASTER!		
G	E	DL	OG	IC D	RIL	L L	og ľ	KOJECI	HAM	LCAAP, Independence, Mo.	PAGE NO. 3 of 3	HOLE NO. 5-7
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE SAMPLE		DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	NO	TES
13	53	8	13 23 50/8"	730-	- 45 -			ML		CLAYEY SILT: well sorted, abundant clay, moist, abundant mottling, red-brown, thin clay lenses		
14 5	SS	-6	50 50/8"	725				Sh		SHALE BEDROCK: well sorted, friable, moist, light gray End of boring @ 50.0 feet	٠	
AST	3) 151 	SPOC	ST CT	= SNE	SY Tues	Use CS =	CONTIN	NOUS	LCAAP SAMPLER Independence, Mg.	PAGE NO.	HOLE NO.

												CXES		
6	:F	OL.	OG	IC D	RIL	LL	.00	3 174	OJECT	HAM	AND LOCATION	Indonesianos M		PAGE NO. HOLE NO. 1 of 2 7-11
31			FIR		DRIL				T	DRILL	HETHOD	Independence, Mo SCREROLE DIAMETER	WELL DIAMETER	TOTAL DEPTH
	/7/		2/	7/88	. La	YBO	-W	ester ELE		E	3-61/HSA D ELEVATION	12" DEPTH/ELEVATION CARD	4° PVC	26.00'
	R		enne	ett			43.5				741.56	• • • •	58'/722.98' 6/1/	1
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	ğ	CONSTRUCTION	CLASS- IFICATION	SAMPLE		DESCRIPTION		NOTES
1	SS	12	3 5 7	740-	-			դեղոլոյոլորդորդորդորդուրդ	OL		TOPSOIL: clayer black	humus, well sorted, le	ow plasticity, moist,	
2	SS	12	5 6 7		5-			չն իրակնին իրակարինին իրականում	CL			me silt, abundant root ndant mottling, black	s, low plasticity,	
3	33	18	4 6 7	735			1914194191919191919491949	իկիկիրիկիկիկիկիկի	CL			l lignite alluvium, som vertical solution chan		
4	SS	18	3 5 8		10-		******************	Patricial state of the state of	мL			abundant clay, trace fi ee, abundant mottling		
5	SS	18	1 2 2	730-	-		344		ML		interlayed clay le	nses, medium gray		
6	55	18	1 2 2		15-				ML					
7	55	16	3 6	725·	-				SM			sorted, trace silt, satu nedium brown	rated, abundant	
	58		1 2 2						SM		some interlayed			
Z	* \$	掛	SPO	ST C	* SHE * COR * CUI	LJY Luc	705E	: 8	ONTI	NOUS	SAMPLER	LCAAP Independence	, Mo.	PAGE NO. HOLE NO. 1 of 2 7-11

•									WEST TO SERVICE AND ADDRESS OF THE PARTY OF		
GE	OL	OG	IC D	RIL	LL	OG	KOJECT	NAM	LCAAP, Independence, Mo.	PAGE NO. 2 of 2	HOLE NO. 7-11
SAMPLE NO.	RECOVERY	SAMPLE BLOUS?	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NO	TES
9 33		268	720-	35-			SM		SAND: fine, well sorted, trace of medium sand and silt, no mottling, saturated, medium brown End of boring @ 26.0 feet	•	
ASTR \$\$ = 1	0 150 50 11	SP too	ST C	Sing			CONTIN	uous	SAMPLER LCAAP Independence, Mo.	PAGE NO. 2 of 2	HOLE NO. 7-11

										,	WES			
GF)L	OG	IC D	RIL	LL	OG	PRO	JECT	NAM	AND LOCATION	Independence Mo			HOLE NO.
YALT		RIT.		DATE			<u> </u>	D	RILL	HETHOD	Independence, Mo sokerole byweter	WELL DIAMETER	1 of 4	7-12 AL DEPTH
2/9/	88	2/1	10/88	La	yne	-We	tern		Gard	ner Davr 500	8"	4" PVC		83.00'
R		enne	ett	100		14.03		. G		741.60	DEPTH/ELEVATION GROW 21.4	13'/720.17' 6/1		
SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	MELL	CONSTRUCTION	CLASS- IFICATION	SAMPLE INTERVAL		DESCRIPTION		N	OTES
			740-	-		Պիկիրիկանիկիրիրիիկիրիկինիկի								
			735-	5- -		કુરા મુખ્ય કુરા કુરા કુરા કુરા કુરા કુરા કુરા કુરા	<u>૧૧ કે કો માને તેમ કે તેમ કે </u>			FOR INFORMAT GEOLOGI	rion from 0 - 25 fe C Log 7-11	et, see		
			730-	10-										
			725-	15-			કરીના માને કર્યા કર્યા મહારા માને કર્યા કર્યા કર્યા કર્યા કર્યા છે. તે કરતા માને કર્યા કર્યા કર્યા કર્યા કર્યા							
STR 0	158	SPOC	ST C.	= \$HE = COR = CLI	.5Y	E SE SE	_	MITIMA	Jous	SAMPLER	LCAAP Independence	. Mo.	PAGE NO	

' E JB	GI	E	DL	OG	IC D	RIL	LL	OG	ROJEC	HAM	LCAAP, Independence, Mo.	PAGE NO. 2 of 4	7-12
FOR INFORMATION FROM 0 - 25 FEET, SEE FOR INFORMATION FROM 0 - 25 FEET, SEE GEOLOGIC LOG 7-11 SAND: fine to medium,ell sorted, saturated, me .um brown wi.h lenses of dark brown SAND: fine to medium,ell sorted, saturated, me .um brown wi.h lenses of dark brown No Recovery	l			SAMPLE BLOUS*	ELEV	ОЕРТН		DONSTRUCTION	CLASS- IFICATION	SAFFLE	DESCRIPTION	NO	TES
					720	-							
	ı	33	7	8	715-	25-		יור וביו ליורים ליו ביורים ליורים	SM		SAND: fine to medium, well sorted, saturated, me num brown with lenses of dark brown		
				10	710-	30 -							
SS 13 30 44 42 40 - 32 34 35 M	3	35	0	8	705	35 - -						No Recov	rery
	3	s	13	44		- 40-			SM SM		SAND: same as above		

GE	0	LOG	IC D	RIL	LL	OG	PROJE	CT HAM	LCAAP, Independence, Mo.	PAGE NO.	7-12
SAMPLE TYPE	1 5	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	7133		SAFE E INTERVAL	DESCRIPTION	NO.	res
4 85	5	17 17 1	695	45-		જુરા _{કર્માં} ભાગ કર્યા છે. તેમ કાર્યા કર્માં કર્યા કર્યા કર્યા છે. તેમ કર્યા કર્યા કર્યા કર્યા કર્યા કર્યા કર્ય	es Maringringringringringringringringringring		SAND: same as above		
5 35	.8	23 27 30		- - 50 -		મહાના પ્રાથમિક મામ મામ મામ મામ મામ મામ મામ મામ મામ મા	er de la		fine, well sorted, trace of silt, saturated, medium brown	•	
S SS	6	8 9 11	690	55 -		ૺૹ૽ૡઌૺૡૺઌૺૡ૽ૡ૽૽ૡ૽૽ૺૡ૽૽ૣ૽૽ૡ૽૽ૡ૽૽ૡ૽ૡૡઌૡૡૡ૽ૡ૽ૡ૽ૡ૽ૡ૽ૡ૽૽ ૡ૽ૺૺઌ૽ૡઌૺૡઌઌૡ૽૽ૡૡૡૡૡૡૡૡૡૡ	iliyi iyi iya iya iya iya iya iya iya iya		SAND: medium to coarse, well sorted, saturated, medium brown		
7 55	10	17 21 25	685 ·	- - - 60 -		***	S. S.		SAND: fine to coarse, poorly sorted, trace of fine gravel, saturated, gray-brown, interbedded with lignite alluvium		
	9 013 PL1	20		-			SM		SAND: same as above, small lenses of abundant silt and clay above lignite layers.		

G	E	DL	OG	IC D	RIL	<u>L L</u>	OG	PROJEC		LCAAP, Independence, Mo.	PAGE NO. 4 of 4	7-12
SATE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE BLOUS*	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	INTERVA	DESCRIPTION	ю	TES
			38	675-	65 -					see above		
9	35	9	18 32 43		70-			SM		SAND: medium, well sorted, trace of large gravel, saturated, medium gray, interbedded with lignite alluvium		
0	33	6	20 19 21	670-	75-			SM		coarse, abundant medium to coarse gravel, trace of limestone fragments, saturated, medium gray		
1	S \$	6		665	80-			SM		SAND: same as above, increase in limestone fragments		
				660	-					LIMESTONE: bedrock at \$2.0' End of boring @ \$3.0 feet		

								PR	JEC	T NAPI	E AND LOCATION	WEST		PAGE NO.	NOLE NO.
L		OL		IC D			<u>OG</u>	L			LCAAP,	Independence, Me		1 of 2	7-13
	ART VO.	/ ee	FIN	8/88 '8/88	DAIL		-Wes	.			HETHOD B-61/HSA	BONENOLE DYANETER 12"	MELL DIAMETER 4" PVC		DEPTH
CO		/88 I	1.4/	0/00	10	न च	3116	ELEV	7.	aloui	D ELEVATION	DEPTH/ELEVATION CHOL	MOUNTER - DATE HEA	SURED	2.00'
_		t. B	ense	ett	<u></u>	74	9.45				746.80	23.9	9'/722.81' 6/1,	/88	· · · · · · · · · · · · · · · · · · ·
SATE NO.	SAFPLE TYPE	RECOVERY "	SAFFLE	ELEV	DEPTH	GRAPHIC LOG	מברר	MAT LOOM LEMOS	CLASS- IFICATION	SAMPLE		DESCRIPTION		NOT	ES
ı	55	5	3 4 6	745				ત્રમાં મુખ્ય મામ મામ મામ મામ મામ મામ મામ મામ મામ મા	OL		TOPSOIL: claye mottling,	y humus, trace silt, root black	s, moist, trace		
2	55	12	6 8 12		Ş-			Philippidelphilippide	ML		CLAYEY SILT: mottling,	well sorted, some clay, r friable, dark gray	noist, trace		
3	SS	14	5 11 13	740				では 日本の日本の日本の	CL		SILTY CLAY: w	eil sorted, trace roots as moist, abundant mottli	nd humus, very low ng, black		
4	SS	16	7 8 11		10-				CL		trace mottling				
5	38	18	4 7 8	735				-	CL		trace silt				
6	38	18	4 5 6		15-				ML		carbonised	well sorted, abundant cl i nodules, some vertical ce mottling, dark gray	ay, trace roots and solution channels,		
7	55	18	3 4 6	730-	•				ML		interbedded with	silty clay			
•	\$6	18	4		4				ML		same as above				
Ţ		1					5	9		NOVE	SAPLER	LCAAP Independence.	Ma	PAGE NO. 1 of 2	HOLE NO. 7-13

G	iE(OL.	OG	IC D	RIL	L L	og ⁿ	ever	- 129t	LCAAP, Independence, Mo.	PAGE NO.	NOLE NO. 7-13
SAMPLE NO.	MANTE TYPE	RECOVERY "	35		HTH	BRAPHIC LOG	WELL	CLASS- IFICATION	SAMPLE Interval	DESCRIPTION)TES
	33		5 14 18	725				SM		SAND: medium, well sorted, trace fine sand and silt, saturated, medium brown		
10	SS	18	3 7 12	720: 715:	30-			SM		fine grained End of boring @ 32.0 feet		
			•									
A3	. 9		3P.00	31 8 C	- 500 - COR	SY II	CS = 1	CONTIN	UOUS	SAMPLER LCAAP Independence, Mo.	PAGE NO.	

													W	47					
6	3E	OL	OG	IC D	RIL	LL	OG	74	OJEC	ILANI	I CA		Independe			1	AGE NO. 1 of 2	NOLE NO.	
	ART		718		DRIL	UN			ı	DRILL	HETHOD	,	SCHEROLE O	ANTER	WELL DIAMETER			B-6 DEPTH	
2	/8/	88	2/	9/88	La	yne of C	-Wes	ter	12	e coli	B-61/HS/	<u> </u>	1: DEPTH/ELEV	2" ATTON GROU	4" PV	C HEAS	3	2.00'	
	R. Bennett 754.57										751.84				9'/726.85' 6				
	T	_		1		T = 1		2		, 									
SAMPLE NO.	SAMPLE TYPE	RECOVERY *	SPIONS	elev	DEPTH	GRAPHIC LOG	מברר	CONSTRUCTION	INTERNAL DESCRIPTION INTERNAL BESCRIPTION INTERNAL								NOTES		
1	58	8	7 10 16	750-				լել Ոլեփլեկ և բնելեկի և	FILL		FILL: miss	ed clay	and silt						
2	3 3	14	8 8 10		5-			والمراوا والوارا والوارا والوارا والواوا والمواوا	CL		CLAY: we	ll sorte sticity,	d, abundant moist, trace	humus, tra mottling, b	ce roots, low lack		•		
3	55	18	4 7 9	745				البالافهارانا للاواليالها الموارافي	CL		trace large	Stave	i, medium bi	rown.					
4	SS	18	6 7 9		10-				CL		lign	ite allu	oundant eilt, ıvium, low p ttling, red-b	lasticity, ab	e sand, fine grav undant red and	rel,			
5	38	18	4 6	740-					CL		trace verti	cal soli	ution channe	la .					
6	55	18	2 4 3		15-				CL		moderate j	pl asti ci	ity						
7	38	18	2 3 3	735	•		1	17.1	CL		medium be	rows							
	38		3 3		•				CL		trace silt								
42	***	出	90	31 30 E7			CS	: 8	ONTIN	NOUS	SAMPLER		Inde	LCAAP endence.	Mo.		AGE NO. 1 of 2	WOLE NO.	

									- 1/214	AND LOCATION		
G	E	OL	OG	K D	RIL	LL	OG	- CORCI		LCAAP, Independence, Mo.	2 of 2	NOLE NO. 8-6
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAFOLE BLOMB		DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NO	- TES
9	35	18	243	730	25-			CL		SILTY CLAY: well sorted, trace silt and lignite alluvium, trace red and yellow mottling, wet, medium brown, vertical solution channels		
10	33	18	4 4 6	725-				CL		no lignite		
				720-	•					End of boring ⊕ 32.0 feet		
7.5		ii.	200	₩ ŞŢ	e COR	LEV II	CS .	CONT IN	NOVE	LCAAP Independence, Mo.	PAGE NO. 2 of 2	

									•		,	W/E	如			
G	E	OŁ	OG	IC D	RIL	LL	OG	PROJ	ECT NAME	L.C.		Independence,	7		PAGE II	
37 /	U.T		FIR	SI	DRIL	CER.			1	, RETRUS		ACHEROTE DIVERS	1.7.5.	WELL DIAMETER	10	TAL DEPTH
2/	10	/88	2/1	5/88	10	yee of C	-Wes	tern	B-6	1/HSA 1	0°ID	14° DEPTR/ELEVATION	GHUM.	4" PVC	EASURED .	40.00'
	R	. B	023 0	tt	<u> </u>		33.14			750.70			27.27	'/723.43' 6/	1/88	<u> </u>
															- 	
SAMPLE ND.	SAMPLE TYPE	RECOVERY "	SHOUS SAMPLE	elev	DEPTH	GRAPHIC LOG	TIEN		SAFEE INTERVAL			OESCRIPTIO	ON			NOTES
1	55	•	4 7 5	750-	•				LL .	PILL: mix	red clay	, silt, shale fragme	nts, mo	ist		
2	33	10	2 4 7		5-		ı Yazılının ile İstanlı ile İstanlığının ile İstanlığının ile İstanlığının ile İstanlığının ile İstanlığının ile			same as a	bove					•
3	33	6	13 10 12	745						same as a	bove					
4	35	14	10 8		10-			*****		same as a	bove		-	···		
\$	55	8	2 3 4	740-	•				L	CLAY: ak bis	oundant sek, old	humus, trace root soil horison	ts, mois	t, trace mottling	•	
6	35	14	2 3 4		15-			3	L	trace hum	nus, dar	k gray				
7	58	18	224	735	•				L	abundant	carbon	ised nodules oxidi:	sed red	and yellow		
	58		2 3 4						L	same as a	bove					
7.5 55	TR.	11	\$P(X	87 20 CT		111	CS CS	e CON	Ilhnana	SAMPLER		LCA Independe	AP	Mo.	PAGE 1 of	

				IC D			7C P	(OUEW)	TAN	LCAAP, Independence, Mo.	PAGE NO.	HOLE NO.	
9		UL	UG		KIL		AG			2 of 2	8-7		
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAPPLE '	ELEV	HEPTH	GRAPHIC LOG	WELL	, H	SAMPLE	DESCRIPTION	NOTES		
9	SS	18	2 3 3	730 - 725 -	25-			CL		SILTY CLAY: trace silt, low plasticity, moist to wet, trace mottling, dark gray	•		
10	35	18	2 2 3 3	720-	30~			CL		abundant silt, trace fine sand, saturated			
11	58	18	2 2 2 2	715-	35-			ML		CLAYEY SILT: trace clay and fine sand, saturated, dark gray			
12	SS	14	1 2 3		40-			ML		some thin lenses of fine sand End of boring @ 40.0 feet		٠	
100	110		300	20 E.	• 10		S3:	SMIT.	NGN8	SMPLER LCAAP Independence, Mo.	PAGE NO. 2 of 2	NOLE NO.	

TAX)L	OG	IC D	RIL	LL	OG	PROJEC		LCAAP,	Independence, Me		PAGE NO.	HOLE NO.
2/1 004	ľ	_	FIR		DEIL				DRILL	RETHOD	BUILDING DIAMETER	WELL DIAMETER		DEPTH
UG S	6/	88	2/1	7/88	L	yse	-West	era	B-6	1/HSA 10°ID	14" DEPTH/ELEVATION CHIC	4º PVC		5.00'
. <u>. </u>		B	enne	<u>tt</u>			4.02	LEV.	GOOM	751.67		31'/723.36' 6/1/		
SAFE NO.	SAMPLE TYPE	RECOVERY .	SAMPLE	e lev	DEPTH	GRAPHIC LOG	HELL CONSTRUCTION	CLASS-	SAPPLE		DESCRIPTION		NO	TES
1 5	3	18	12 21 7	750-				Editoria de la como dela como de la como de la como de la como de la como de la como dela como de la como de la como de la como de la como de la como dela como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la como de la		FILL: clayey silt, brown	trace sand, very stiff,	moist, medium		
2 5	3	18	15 15 22		5-					trace shale fragm	ents, small gravel, root	and mottling	•	
3 5	S	18	12 13 17	745	•					gray to brown-gr	v ea	,		
4 5	S	18	3 4 4		10-		**********	CL		SILTY CLAY: al moist, dar	oundant silt, trace fine k brown	sand and roots,		
5 3	S	18	3 3 4	740-						trace fine gravel,	dark brown to black			
6 S	3	18	1 2 1		15-		**********			high plasticity, b	leck			
7 3	3	18	4 6 7	735				CL CL		moderate plastic	ty, trace oxidation on (line gravel		
	8	18	4				HAMMAN	e cr		medium gray				

										WESTER]	
(jΕ	OL	OG	IC D	RIL	LL	.OG	PROJE	EY NA	LCAAP, Independence, Mo.	PAGE NO. 2 of 3	HOLE NO. 8-8
SAFPLE NO.	۲	RECOVERY	SCOUSE	ELEV	DEPTH	GRAPHIC LOG	WELL		SAPLE	DESCRIPTION	МО	TES
9	33	18	4 6 5	730·	25-					abundant siit		
10	55	18	2 3 3	720-	30 -		¥	CI		trace fine sand		
11	33	18	2 1 2	715-	35 -			MI		CLAYEY SILT: well sorted, abundant clay, trace fine san high plasticity, wet, olive green-gray	d,	
	33		2 4 4	710	40 -			MI		same as above		
*A \$8	• \$) 158 PL [] PM [9900 900	W C	SIE	LUY I	CS .	CONT	MUOUS	LCAAP Independence, Mo.	PAGE NO. 2 of 3	

									WEST OF THE STATE		
GE	OL	OG	K D	RIL	LL	OG	KOJECI	TAN	LCAAP, Independence, Mo.	PAGE NO.	HOLE NO.
SAMPLE NO.		SAFFLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	SAFFLE	DESCRIPTION	МО	TES
13 55		1 2 2 3		45-			SM		wet, medium gray SAND: fine to medium, well sorted, trace silt, wet, medium gray End of boring @ 45.0 feet		
										•	
ASTA S =	015I	\$200	CH C	= SHE	LBY	TUBE CS = CT =	CONTI	Nous	SAMPLER LCAAP Independence, Mo.	PAGE NO.	

		OL		IC D			.OG	PR			LCAAP,	Independence, Mo.		PAGE NO. 1 of 2	HOLE NO
	RT /1 /		FIN	2/88	DRIL		-We		- 1		METHOD B-61 HSA	12"	4" PVC	1	C BEPTH 34.00'
Ž.	GE	88	<u> </u>	2/00	TOP	of C	ASTING	ELE/	7.		D ELEVATION	DEPTH/ELEVATION GROW	MOWATER - DATE MEAS	SURED	14.00
	R	. В	enne	tt	<u>l</u>	7.	48.22	2			746.20	24.1	<u>6'/722.04' 6/1/</u>	88	
SMITTE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	ОЕРТН	GRAPHIC LOG	WELL		CLASS- IFICATION	SAMPLE		DESCRIPTION		ю	TES
	SS	12	6 12 14	745-	-				FILL		plasticity,	trace silt, roots and ligni moist, abundant mottlin brown, dark brown	ite alluvium, low ng, interlayed		
2	SS	16	10 13 14		5-		փիկիիիիիիիիիիիիիի	Application of the state of the			medium brown			•	
3	33	18	5 5 7	740-			Mahamatanahan	elitetelitetelitetelitetelitete			trace vertical sol	ution channels			
4	SS	16	3 3 6		10-		444444444444	iphippidiphippidip	SM		SAND: fine, well moist, tra	sorted, abundant silt, a ce vertical solution chan:	oundant mottling, nels, medium gray		
5	SS	18	3 3 6	735	-		Halifultifatethilitatif	diphiphiphiphiphip	SM		some silt, no solu	ition channels, moist to	wet		
3	SS	18	4 4 1		- 15				SM		medium, medium	a brown			
7	33	14	3 2 1	730	-				ML			bundant fine sand, mode set, medium brown	rately sorted,		
8	SS	18	4 3 1		-				ML			ne, moderately sorted, al edium brown	oundant silt, moist		

										WESTERN		
G	E	OL	OG	IC D	RIL	L L	OG P	ROJECT	NAM	LCAAP, Independence, Mo.	PAGE NO. 2 of 2	HOLE NO. 12-5
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE BLOUS*	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	, NO	TES
9	33	18	3 4 3	725				SM		fine, moderately sorted, abundant silt, wet, medium brown		
10	33	18	4 3 2	720-	25 -			SM		trace silt		
11	33	18	3 3 3	715-	30 - - -			SM				
										End of boring ⊕ 34.0 feet		
95 55		Į.	2700	# §7	器	7	GI :	CONT I	none	LCAAP Independence, Mo.	PAGE NO.	

							PROJ	ECT N	WE	AND LOCATION CONTINUES	PAGE NO. HOLE	NO.
						OG				LCAAP, Independence, Mo.	1 of 5 12-	
TART		FIN		DRIL				1 .			TOTAL DEPT	
2/15 OGGE		1 2/	16/88	10	of CA	- Wes	tern ELEV.	GR		A/Tri-come 8" 4" PVC DELEVATION DEPTH/ELEVATION GROUNDWAYER DATE MEA	86.50'	
	R. B	enne	tt		74	<u>5.26</u>				743.30 21.30'/722.00' 6/1/	88	_
SAMPLE TYPE		SAMPLE	ELEV	ОЕРТН	GRAPHIC LOG	WELL	NOT LOOK KNOO	IFICATION	INTERVA	DESCRIPTION	NOTES	_
1 SS	8	4 4 6		•		յուների և արևարկանի արևարկանին և և և և և և և և և և և և և և և և և և	પ્રમાણ પ્રાથમિક ભાગ છે. મુક્ત મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્યા મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્ય મુખ્ય	ol -	200 (1) 200 (1) 200 (1)	TOPSOIL: clayey humus, fine, abundant roots, moist, black		
2 55	12	4 5 6	740-	5-		11,11,11,11,11,11,11,11,11	hila phila philada	ZL		CLAY: trace silt, lignite alluvium and roots, moist, abundant mottling, red-brown		
3 33	16	3 5 6					handalanda ha	z		interlayered with sand		
33	16	6 7 9	735 -	10-			բիրիկիկիկիիրիրի	M		SAND: fine to medium, moderately sorted, trace silt and lignite fragments, some thin clay lenses, saturated, abundant mottling, red-brown		
SS	18	1 1 1		-		ր Մարդարարարարարարարարարարարարարարարարարար	THE THE PARTY OF THE PARTY OF THE PARTY.	æ		SILT: moderately sorted, trace lignite fragments, some thin clay lenses, saturated, abundant mottling, red-brown		
ss	18	2 2 1	730-	15 -			3	Œ		same as above		
55	18	6 7 8		-				м		SAND: fine to medium, well sorted, trace silt, saturated, brown		
55	14	12 15 15	725			ALIPARITE CONTRACTOR	And Parketing	M		same as above		
STR	515 PL11	5 9900	M C	= SHE = COR	INGS CBV	ÇŞ	= CON	TINUC	ous :	LCAAP Independence, Mo.	PAGE NO. HOLE 1 of 5 12-	

G	E	OL	OG	IC D	RIL	LL	.og ľ	ROJEC		LCAAP, Independence, Mo.	PAGE NO. 2 of 5	12-6
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE BLOUS*		DEPTH	GRAPHIC LOG	MELL CONSTRUCTION	CLASS- IFICATION	SAPPLE	DESCRIPTION	NOT	res
9	SS	16	14 19 25	720-	25 -			SM		same as above		
10	33	8	4 5 5 5	715-	30 -			SM		fine, moderately sorted, trace medium sand and silt, trace lignite alluvium, dark brown,		
11	33	14	18 28 31	710-	35-			SM		medium brown, no lignite		
12	38	8	14 13 15	705	40-			SM		same as above		

											WESTERN		
G	E	OL	OG	IC D	RIL	LL	.OG	PRO	MECT	NAME OF THE PERSON OF THE PERS	LCAAP, Independence, Mo.	PAGE NO. HOLE 3 of 5 12-	
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	WELL		CLASS- IFICATION	SAMPLE	DESCRIPTION	NOTES	
13	SS	14	15 16 19	700-	45 -				SM		trace silt and coarse sand		
14	SS	5	40 50/4	695	50-		والمراحات المراجات والمراجات المراجات المراجات والمراجات لمراجات والمراجات والمراجات والمراجات والمراجات والمراجات والمراج والمراجات والمراجات والمراجات والمراج والمراج والمراج والمراج والمراج والمراج والمراج والمراح والمراج والمراج والمراج والمر		SM		fine, trace silt and medium sand	•	
15	SS	14	27 25 29	690-	55-				SM		medium, trace silt and coarse sand		
16	58	16	30 28 33	685	60-				SM		fine grained, well sorted, trace silt .		
17 *A\$ \$\$	58 TH	14 5158	19 \$P00	680-	SHEL		CS		SM NT I N	JOU'S.	LCAAP Independence, Mo.	PAGE NO. HOLE 3 of 5 12-	

G	E	OL	og	IC D	RIL	LL	.og	HOJEC	THAN	LCAAP, Independence, Mo.	PAGE NO.	12-6
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	BLEV	DEPTH	GRAPHIC LOG	WELL	CLASS-	INTERVAL		МО	TES
			33		6 5 –					coarse, poorly sorted, trace silt, fine sand and fine gravel, trace light brown shale		
1.8	SS	10	18 25 33	675	70~			SM		same as above		
9	33	8	12 15 16	670-	75-			SM		same as above		
0	SS	12	21 31 36	665	30 -			SM		fine to coarse		
	58	10	12 25 16	660	85 ~			SM		SAND: fine to coarse, poorly sorted, trace fine gravel, saturated, medium brown		

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										WEST OF THE STATE		•
G	E	OL.	OG	IC D	RIL	LL	OG	OJECT	HAN	LCAAP, Independence, Mo.	FAGE NO.	WOLE NO. 12-6
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVA	DESCRIPTION	NOT	TES
										LIMESTONE End of boring @ \$6.5 feet		
										·		
*A3		OTSE PLIT	SP00	N Ç	= SHE	8V	C\$ = 0	NITHO	NOUS	SAMPLER LCAAP Independence, Mo.	PAGE NO. 5 of 5	HOLE NO. 12-6

		OL		C D	RIL		.OG	Pit			LCAAP,	Independence, Mo.	1	PAGE NO. NOLE NO. 1 of 2 14-1
74		/ 00	FINI	511 6/ 88	1		_₩_	**	- 1	DMILL	HSA	10"	4" PVC	35.00°
6		88	11/4	9/00	10	of C	-Wes	ELE	.	GKOUN	D ELEVATION	DEPTR/ELEVATION CHOL	MUNTER - DATE HEAS	URED 33.00
	R	. B	ebbe	<u>tt</u>	<u></u>		16.93				745.00	20.1	9°/724.81° 6/1/1	88
SHIPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	1134	CONSTRUCTION	CLASS- IFICATION	SAMPLE INTERVAL	<u> </u>	DESCRIPTION		NOTES
1	\$ \$	4	6 5 5	745			1-14-1-14-1-14-14-14-14-14-14-14-14-14-1	त्रकृतक्षित्वकृतिकृतिकृतिकृतिकृतिकृतिकृतिकृतिकृतिकृति	FILL		FILL: silty clay, moist, tra	abundant silt, trace roo ce mottling, dark brown	ts, low plasticity,	
2	33	18	4 4 6	740-	5-		4191-1419-1414-1414-1414-1414	defestatististististististististististististist			mixture clay, sil medium b	t, and fine sand, trace co rown	oarse gravel,	.• ·
3	SS	18	2 2 3 3		•		25		CL		SILTY CLAY: a wet, trace	ome silt and humus, more mottling, black, older s	derate plasticity, oil horison	
4	SS	18	2 3 2	735	10-				CL		older soil horison	.		
5	33	18	3 6 5						CL		abundant silt, tr plasticity	ace fine sand and lignite moist, some mottling, o	r fragments, low lark gray	
6	53	18	5 6 7	730	15-				CL		trace silt and lig	nite, abundant mottling	, medium gray	<u>.</u>
7	3 8	18	244						CL		abundant lignite	: fragmente		
•	~	10	• 20 •		•				M		SAND: fine to m lignite, se	edium, moderately sorte turated, medium brown	ed, trace silt and	

CE			K D	DII		06	over	NA)	AND LOCATION	PAGE NO. NOLE NO.
GE	<u>UL</u>	UG	C D	KIL	<u> </u>	<u>od</u>			LCAAP, Independence, Mo.	2 of 2 14-1
SAMPLE NO.	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	N WELL SOMETRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NOTES
9 55	18	4 5 6	720	25-			SM		fine to medium, moderately sorted, silty clay at 25'	No sample taken here due to sand
SS	12	6 8 13	715-	30 - - -			SM		SAND: fine to coarse, poorly sorted, abundant silt and clay, saturated, medium gray End of boring @ 34.5 feet	heave in augers
/A21H	5158 PLIT	secc	m . Ç.	- SNE		CORE	CONTIN	UOUS	SMPLER Independence, Mo.	PAGE NO. HOLE NO 2 of 2 14-1

												W	47			
6	E	OL	OG	IC D	RIL	L L	OG	7	OJEC	NA ST	L CAAR	Independer			PAGE NO	
31			771		on C			<u></u>		DATLL	HETHOD	SOMEWOLE DI	WEIGH	WELL DIAMETER		AL DEPTH
14	27	/88	1/:	28/88	La	yee-	Wes	ter			B-61/HSA B ELEVATION	12		4" PVC	ACTION	23.50'
۳			lenno	ett			EBOW Stan		"		735.83	DEPTH/ELEVA		8'/723.05' 6/1		
Γ																
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	TIM		CLASS- IFICATION	SAFFLE		DESCRI	PTION		N	OTES
1	35	4	4 3 4	735	•			والمالية والموالية والمالية والمالية المالية المالية المالية والمالية والمالية والمالية والمالية	OL		TOPSOIL: clay	ey humus, well	sorted, mo	oist, black		
2	55	14	4 7 10		5-				CL		CLAY: trace hu mottling		, low plasti	city, moiet, trace		
3	33	18	5 7 9	730	-	20			CL		trace silt and li	mite fragments	, trace oxi	dised nodules		
4	33	18	4 4 5		10-				CL		abundant motti	ing, light gray				
5	55	18	3 3	725	-				CL		same as above					1
6	55	18	4 5 6		15-				SM		SAND: well sort some lay	ted, fine, trace : ered lignite allu	silt, saturs ivium	sted, light brown,		
7	SS	18	4 3 4	720-	•				5M		medium brown					
	55		2 9 7						SM		interbedded wit			ted, medium gray		
7 <u>1</u> 55	= S	1	SPO	DE CT	• 344 • CD	1112	CS	: 2	COLLIN	uous	SAMPLER	Indepe	LCAAP ndonce.	Mo.	PAGE IX	

										WASTERN .	
G	E(OL	OG	IC D	RIL	LL	OG	KOJECI	TAN	LCAAP, Independence, Mo.	PAGE NO. HOLE NO. 2 of 2 14-2
SAMPLE NO.	SAMPLE TYPE	MECOVERY "	SAVELE BLOUS?	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	SAFE E	DESCRIPTION	NOTES
9	33	18	4 9 7	715-				SM		SAND: with interbedded silty clay lenses as above	
										End of boring # 23.5 feet	
*A\$	THE C	7150 211	\$200	= S1 ■ C ₂	= \$10E	Inc	CS =	CONTIN	uous	SAPLER LCAAP Independence, Mo.	PAGE NO. HOLE NO. 2 of 2 14-2

_				IC D			OG	PRO.			LCAAP, Inde	pendence, Me		1 of 2	
	ART /20	/88	1	1/88	DRIL	LEK LYBO-	Was		Di		HETHOD BONES	DLE DIAMETER 12"	WELL DIAMETER 4" PVC	!	L DEPTH
.0		/ 0e	2/	1/00	10	of CA	110	LEV.	G		D ELEVATION DEPT		MOUATER - DATE HEA	SURED	20.50'
	<u>.</u>	<u>. E</u>	lenne	tt		73	<u>7.78</u>		1.	<u>-</u>	735.33	12.8	2'/722.51' 6/1/	88	
SEPTE NO.	SAMPLE TYPE	RECOVERY *	SAMPLE	elev	DEPTH	GRAPHIC LOG	WELL		IFICATION	INTERVAL	DI	ESCRIPTION		но	TES
1	33	14	2 4 5	735-					DL.		TOPSOIL: clayey humo trace oxidised no		w plasticity, moist,		
2	SS	18	4 4 6		5-						trace lignite and mottli	ng, dark gray		·	
3	33	18	4 4 5	730					SL.		SILTY CLAY: trace silplasticity, moist,	t and lignite frag abundant mottli	ments, low ng, medium gray		
4	33	18	1 2 1	725-	10-			(ZL .		high plasticity, wet, da	rk gray			
5	33	18	4 3 2		-			S	м		SAND: fine to medium, alluvium lenses, medium gray	well sorted, trac saturated, abund	e silt and lignite ant mottling,		
6	5 \$	10	3 1 1	720	15-			s	M						
7	SS	18	1 1/2 1/2	/201	-			s	м		fine, very silty, interlay	ered silty clay les	1906		•
•	58	18	1 1 1		-			s	м		continued interlayered	nilty clay			

							•			MAETICAL Y		
6	3F	OI.	OG	IC D	RIL	LL	.OG	FOJECT	NAM	AND LOCATION		HOLE NO.
F		<u> </u>							·	LCAAP, Independence, Mo.	2 of 2	14-3
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAFFLE	ELEV		GRAPHIC LOG	MELL	CLASS- IFICATION	INTERVAL	DESCRIPTION	NOT	ES
3	3			715-						End of boring 20.5 feet		
77	7 P	TI,	200	Š,			3:		101K	LCAAP Independence, Me.	PAGE NO. 2 of 2	HOLE NO. 14-3

			IC D	RIL		.OG	Pik			LCAAP,	Independence, Me	. WELL DIAMETER	1 of 4	HOLE N
ART /17	/88	FIN: 2/1	18/88	ı		- We:	ter	- 1		ner-Davr 500	8"	.4" PVC	7	DEPTH 8.50'
GGE		enne	tt	TOP		38.60		/. G	- ROUM	736.13	DEPTH/ELEVATION GROUNDS: 13.7	18'/722.35' 6/1/		
SAMPLE TYPE	1 22	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CONSTRUCTION	CLASS- IFICATION	SAFFLE		DESCRIPTION		NOT	ES
			735-	-										
			730	5 - -			մի Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան Միկան			FOR INFORMA GEOLOG	TION FROM 0 - 20 FE IC LOG 14-3	ET, SEE		
			725	- 10 - -			isalelsialisialifiaasi kaninaninaninaninaninanina							
			720-	15 -			******							

G	E	OL	OG	IC D	RIL	LL	OG	PROJECT	T NAME	LCAAP, Independence, Mo.	1 1	E NO. 4-4
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NOTES	
				715-	-		rigation of the order	Halahinlaria in alamata				
1	33	12	17 21 20	710-	- 25 -		արկանի այր ինչին հայտինականի այր ինչին ինչին հայտինային Ինչին ինչին ինչին հայտինականին ինչին ինչին ինչին	SM		SAND: fine, well sorted, trace silt and lignite alluvium, saturated, medium brown	•	
2	33	14	7 6 12	705-	- - 30 -		ի հերկանին երերանական արևանականը արագարանին արդերանին երերանին արևանին իրերանին երերանին արևանականում արդերանի 	SM		medium grained	·	
3	SS	14	20 36 38	700-	35 -					fine grained		
4	3 5	16	14 19 21	695	40-			SM		fine to medium		

							· · · · · · · · · · · · · · · · · · ·			AND LOCATION		
G	E	<u>OL</u>	OG	IC D	RIL	L L	OG	- —	- NAPE	LCAAP, Independence, Mo.	3 of 4	14-4
SAMPLE NO.	SAMPLE TYPE	RECOVERY	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	⊨	SAFFLE	DESCRIPTION	NO.	res
5	33	16	6 12 14	690 -	45-			SM		SAND: fine to medium, moderately sorted, trace silt and fine gravel, saturated, medium brown with interbedded lignite alluvium lenses		
6	33	.4	9 11 12	685-	- 50 -		անգայությանը արդարարարարարարարարարարարարարարարարարար	SM		fine to coarse, poorly sorted, trace silt and coarse gravel		
7	SS	1	12 12 12	680-	55 -			SM		same as above		
	SS	14	14 14 18	675-	60-			SM		fine to medium, moderately sorted, trace silt, fine gravel and lignite alluvium		
	SS	18	13	₩ Č.				SM		SAND: fine to medium, moderately sorted, trace silt and coarse sand, thin lenses of lignite alluvium. LCAAP Independence, Mo.	PAGE NO.	HOLE NO.

							P	OJECT	TANK	E AND LOCATION	PAGE NO. HOLE NO
G	E(<u>OL</u>	OG	IC D	RIL	LL	OG			LCAAP, Independence, Mo.	4 of 4 14-4
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	ОЕРТН	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	NOTES
			17	670-	65 -					saturated, medium brown	
10	SS	12	12 13 15	665	- 70 - -			SM		fine to coarse, poorly sorted, no lignite	•
11	33	10	15 12 11	660	- - 75-			SM		same as above	
					-					LIMESTONE End of boring @ 78.5 feet	
VAS SS	TR - \$	DTSE PLIT	spoo	ST W C	= SME = COR	BY IMG	CS = (CONTIN	uaus	LCAAP Independence, Mo.	PAGE NO. HOLE NO. 4 of 4 14-4

GEOL	OGIC	Dŧ	RILL	. L	OG	Pile	JEC	T NAME	FAIG LOCATION	Independent	S		PAGE NO	. HOLE NO.
START	FIRE	T	BRILL				- 1		METIKOD	SCHEMOLE DIVE	ETER	WELL DIAMETER		AL DEPTH
1/21/88 Occes	1/23/1	88	La	y Be	-We	steri		Gard	iner Davr 50 D ELEVATION	7 7/8		4" PVC	O DEN	94.00'
	Bartz				0.73				738.30			3'/724.87' 6/1	_	
SAMPLE TYPE RECOVERY "	SAMPLE	EV	ОЕРТН	DRAPHIC LOG	MELL	CONSTRUCTION	CLASS-	SAFFLE		OESCRIP	TION		2	OTES
	73	35-	5		in in the state of	indiving interpretation of the property of the			FOR INFORM GEOLO	ATION PROM 0 GIC LOG 16-7	- 30 PE	et, see		
ASTR DIS	SPOON .	٠ او د ع		37	S	. 8	M11	MUOUS	SAPLER	L Indeper	CAAP	. Mo.	PAGE N	

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	***	OL	OG	IC D	RIL	Ll	.OG	PROJECT	WAR	LCAAP, Independence, Mo.	PAGE NO. 2 of 5	HOLE NO
SAMPLE NO.	SAFPLE TYPE	RECOVERY "	SAFFLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	SAMPLE	DESCRIPTION	ron	ES
				715-	25-		olegistering bering bering bering bering bering bering bering bering bering bering bering bering bering bering Berinde berind berind berind bering bering bering bering bering bering bering bering bering bering bering beri			FOR INFORMATION FROM 0 - 30 FEET, SEE GEOLOGIC LOG 16-7		
				710-	30-							
1	33	10	18 16 15	705	35 -					SAND: medium, well sorted, loose, subrounded, wet, gray		
2	33	14	9 9 10	700	40-			SM		fine grained		

GE	0	LOG	iC D	RIL	LL	og '	KOJECI	NAME	LCAAP, Independence, Mo.	PAGE NO.	16-6
SAMPLE TYPE		SAPPLE	ELEV	DEPTH	GRAPHIC LOG	DONSTRUCTION	CLASS- IFICATION	SAPPLE	DESCRIPTION	NO	TES
3 33	3 10		695	45-		**************************************	SM		interbedded SAND and CLAY: sand is fine to medium, well sorted and rounded, loose, wet, gray; clay is silty, very soft, saturated, thin lenses, gray, trace wood debris		
SS	4.5	11 11 13	690	50-		րարարարարարարարարարարարարարարարարարարա	SM		same as above	-	
5 55	9	14 14 17	685 -	55 -			SM		same as above		
SS	7	9 10 11	680-	- - 60 -					medium to coarse grained, large fragments of lignite		
81		14	675	•			SM		well sorted, medium grained		

(ìΕ	OL	.OG	IC D	RIL	LL	OG	PROJEC	NAM	LCAAP, Independence, Mo.	PAGE NO. 4 of 5	16-6
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE BLOUB'S	ELEV	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS- IFICATION	SAFE	DESCRIPTION	NO	TES
			19		65 -							
8	S S	8	12 17 14	670-	70 -			SM		same as above silty clay lense at 70° is very soft		
9	SS	8	23 13 14	665	75-			SM		SAND: medium, well sorted and rounded, loose, wet, gray		
0	33		12 12 17	660	80-			SM		same as above		
.1	38	12	13 19 20	655	85-			SM		abundant lignite alluvium in thin layers		

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										WESTER		
G	E	OL	OG	IC D	RIL	LL	OG	OJECT	NAME:	LCAAP, Independence, Me.	PAGE NO. 5 of 5	16-6
						,						
SAMPLE NO.	SAFFLE TYPE	RECOVERY "	SAMPLE BLOUS*	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	NO	TES
12	SS	3	13 50/2*	650-	90-			Sh		SHALE: weathered surface, sandy, slightly fissile		
13	SS	0	.09/2	645-	-			Sh		SHALE: as above, no recovery End of boring @ 94.0 feet	NO REC	OVERY
		-										
												٠
AST S			3700	81 C C7	SACTOR OF THE PROPERTY OF THE	Į mos	08 = 0	ONTIN	vous	LCAAP Independence, Mo.	PAGE NO.	HOLE NO.

		OL		IC D			OG				LCAAP, Independence, Mo.	PAGE NO. HOLE N
	RY		PIN		ORIC		w	.			HETHOD SCHEROLE DIAMETER WELL DIAMETER	1.0
6		/83	11/4	1/88	10	of U	-Wes	ELE	v.		E 750 HSA 10" 4" PV D ELEVATION DEPTR/ELEVATION GROUNDWAYER DAYE	C 30.00'
-]	P. 1	Bart	<u> </u>		74	0.27				738.26 12.37'/725.89'	i/1/ 88
SPETELE IND.	SAMPLE TYPE	RECOVERY "	SANDLE	BLEV	DEPTH	GRAPHIC LOG	1134	CONSTRUCTION	CLASS- IFICATION	SAHPLE INTERVAL	DESCRIPTION	NOTES
L	55	8	6 7 15			HERMANNE		milyking bing bing in this child bing bing bing bing b	OL		TOPSOIL: silty loam, well sorted, moist, dark brown	
2	\$ \$	17	5 5 15	735-	5-			الإعاباء إماله إماما الامتراطية	CL		SILTY CLAY: well sorted, abundant silt, low plasticity, moist, trace mottling, dark gray-brown	•
	S S	17	3 4 6					<u>૽ૺૡૡ૽ઌ૽ઌ૽ૡૡ૽ૡઌઌઌઌ૽ઌ૽ઌ૽ૡૡૡૡઌઌઌઌ</u> ઌ	CL		same as above	
۱	55	17	4 4 6	730	10-			4474474474474	CL		trace roots	
B	58	17	5 7 10				1	******	CL		some mottling	
3	55	18	2 3 4	725-	15-				CL		thin lense of very soft clay	
	55	18			•				CL		trace fine sand, moderate plasticity, abundant mottling	
	58	18	3 3	720	•				CL		trace medium sand, wet	

										WASTERN.		
G	E	OL	OG	IC D	RIL	LL	OG	NOJECT	NAUG	LCAAP, Independence, Mo.	PAGE NO. 2 of 2	HOLE NO. 16-7
SAFFLE NO.	SAMPLE TYPE	RECOVERY *	SANTE BLOUS?		DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAFFLE	OESCRIPTION	NO.	res
9	33	18	1 1 1					CL		trace fine sand, high placticity, some thin silt lenses, wet, gray		
10	55	18	3 5 6	715	25 -			ML		CLAYEY SILT: some clay, semi-soft, saturated, gray	•	
11	33	16		710	-			SM		SAND: fine to medium, well sorted, trace silt and clay, saturated, gray		
					30 -					End of boring ⊕ 30.0 feet		
								-				
725		JYSO M. IT	9 F02	81 10 C	- SHE	51	CS =	CONTIN	UOU:	SUPLER LCAAP Independence, Mo.	PAGE NO. 2 of 2	NOLE NO. 16-7

ON BLANCE NO.	R. E. RECOVERY	J's	2/88	La	yee of C	9.94		I	I	B-61/HSA D ELEVATION	Independence, Mo. BOREHOLE DIAMETER 12".	4" PVC	TOTAL DI 24.0	EPTN
ON BLANCE NO.	RECOVERY "	lenne	tt_		74	9.94		V. 6	KOUR	DELEVATION	TAKEN PART BURNEY			00,
ON HITCHOS	RECOVERY "			, <u>, , , , , , , , , , , , , , , , , , </u>						747.10	I .	6'/734.54' 6/1/	SURED	
1 55		SAFFLE		Į	8									
2 55	10			DEPTH	GRAPHIC L	TIM		CLASS- IFICATION	SAMPLE Interval		DESCRIPTION		NOTES	3
		2 3 5	745-	•				OL			ry humus, some roots, ser to black	ni-soft, moist,		
	12	5 10 8		5-			հիլելերի հերկերեր			trace red stainir		·		
3 33	18	2 4 5	740-		E			CL		CLAY: trace lig brown, m	nite fragments, moderate ay be disturbed	plasticity, moist,		
4 33	18	2 2 1		10-				CL		high plasticity				
6 58	18	1 1 1	735-			3		CL		wet, undisturbe	i			
6 55	18	1 1 2		15-				CL		trace silt				
7 38	18	2 2 2	730-	-				CL		trace fine gravel				
3 55	18	3 2 2		-				CL		no gravel		İ		

ECOLOGIC DRILL LOG PROJECT HAVE AND LOCATION LCAAP, Endependence, Mo. PROJECT HAVE AND LOCATION LCAAP, Endependence, Mo. PROJECT HAVE AND LOCATION PRO	· ·		9	SAM	BAMPLE NO.	G		
DESCRIPTION NOTES LCAAP, Independence, Me. 2 of 2 16-8 LCAAP, Independence, Me. 2 of 2 16-8 NOTES			SS	3	LE TYPE	E		
CL Trace silt and eand, trace lignite fragments, trace mottling. End of boring @ 24.0 feet CAAP Mar.			18	RECO		OL		
ELEN DO THE LOG LCAAP, Independence, Me. 2 of 2 16-8 CL Trace silt and sand, trace lignite fragments, trace mostling, brown End of boring @ 24.0 feet			2 2 2	2 4	PPLE OUST	OG		
CL Trace silt and eand, trace lignite fragments, trace mottling, brown End of boring @ 24.0 feet			725		ELEV	IC C		
LCAAP, Independence, Me. 2 of 2 16-8 DESCRIPTION NOTES CL trace silt and sand, trace lignite fragments, trace mottling, brown End of boring @ 24.0 feet				a	FOTH	RIL		
CL Trace silt and sand, trace lignite fragments, trace mottling, brown End of boring @ 24.0 feet	3			GRAP	HIC LOG	LL	-	
CL Trace silt and sand, trace lignite fragments, trace mottling, brown End of boring @ 24.0 feet		and the second		Sows 1	PELL	OG "		
LCAAP, Independence, Mo. 2 of 2 16-8 DESCRIPTION NOTES NOTES LCAAP LCAAP, Independence, Mo. 2 of 2 16-8 NOTES	127		CL	o i	ASS-	IOJECI	CATIFRE	
DESCRIPTION DESCRIPTION NOTES Trace silt and sand, trace lignite tragments, trace mottling, brown End of boring @ 24.0 feet	No. of Contract of			IN	WPLE FRUGE		- 0.10	
NOTES	LCAAP .		brown		DESCRIPTION		WASTEN !	
TES					NOT	1 1		
					'ES			

GEOL	ogi	C D	RIL	 L L	og	PRO	JJEC?	T KAN	F AND LOCATION	W		PAGE NO. HOLE NO.
START	FIRIT		DATE			<u> </u>		DRILL	METHOD	Independence, Mo.	WELL DIAMETER	1 of 3 16-9
1/27/80 LOGGER	1/2	7/88	La	yne	-Wes	ter		Gard	ner-Duvr 500	7 7/8" DEPTH/ELEVATION GROUN	4" PVC	50.00
	Bartz				50.01	ELEV	'		747.10		8'/724.82' 6/1	
SAMPLE NO. SAMPLE TYPE RECOVERY **	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	TIEST I	CONSTRUCTION	CLASS- IFICATION	SAMPLE		DESCRIPTION		NOTES
		745-	10-						FOR INFORMA GEOLOG	TION FROM 0 - 20 FEI IC LOG 16-8	et, see	
Admit I	900	81 6 27				-		Nove	SAPLER	LCAAP Independence.	Mo.	PAGE NO. HOLE NO. 1 of 3 16-9

GE	<u> </u>)L(OG	IC D	RIL	L LC	G	OJEC	NAME.	LCAAP, Independence, Mo.	PAGE NO. 2 of 3	HOLE NO. 16-9
i		RECOVERY *	SAMPLE		DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAPPLE	DESCRIPTION	NO	TES
1 5	8	16	2 2 1	725	25-			CL		SILTY CLAY: abundant silt, well sorted, soft, saturated, trace mottling, brown		
2 S:	S	18	1 1 2 2	720-	30-			CL		very moist, gray		
3 8	5	118	1 1 1	715-	35 -			CL		some silt, abundant wood debris, very soft		
4 5	5	LG	1 1 1	710-	40-			CL		vety silty, trace pebbles		

										WEST TO THE PARTY OF THE PARTY		
9	iΕ	OL	OG	IC D	RIL	LL	og ľ	ROJECI	NAN	LCAAP, Independence, Mo.	PAGE NO.	HOLE NC. 16-9
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	INTERVAL	DESCRIPTION	NO	TES
5	33	14	10 8 8	703	45-			SM		SAND: fine, well sorted, rounded, loose, wet, gray		
6	ss	.6	14 18 17	700-	50-			Sh		SHALE: weathered surface, fissile, trace sand, blue-green End of boring @ 50.0 feet		
										·		
					·							
*A5	1 S	715	SP00	SY E	• 900 • CON		USE CS = (STREET IN	uous	SAMPLER LCAAP [Independence, Mo.	PAGE NO.	HOLE NO.

												WES			
6	:E	Oi	<u> </u>	IC D	RII	LI	00	P	OJEC	NAM	AND LOCATION			PAGE NO.	HOLE NO.
Į.	ut'	<u> </u>	TFIN		TORIL				-	DRILL	HETHOD	Independence, Mo	WELL DIAMETER	1 of 3	16-10 DEPTH
1/	27	/88	2/	2/88	La	ye	-We	este	70	ΑΊ	V/Tri-cone	8	4" PVC	6	4.00'
ΕŌ	GE I		Bart	_	TOP		asin 65.4		v .	GROUN	762.70	DEPYN/ELEVATION GROU	MOUATER - DATE HEA 86'/747.84' 6/1/		
		F	Dar t	<u> </u>	L		03.4	<u> </u>			702.70	1 40	0 / 141.84 0/ 1/	7.00	
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SHOUS	ELEV	DEPTH	GRAPHIC LOG	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CONSTRUCTION	CLASS- IFICATION	SAMPLE		DESCRIPTION		NO ¹	res
1	33	4	3 3	760-			iliplotifichtifichtifichtifich	ને પ્રાથમિક કર્યા કર્ય	CL		SILTY CLAY: w	ell sorted, soft, semi-mo	ist, dark brown		
2	55	15	3 4 5		5-		11111111111111111111111111111111111111	Philiphiphiphiphiphiphiph	CL			metallic small rounded o mi-soft, cohesive, semi-			
3	35	18	3 3 2	755-			19994999199999999999		CL			ling, some red-brown m f very fine buff sand, un			
4	SS	17	3 3 3		10-		դիդիկրիկրկիկիիի	i i i i i i i i i i i i i i i i i i i	CL		semi-moist with where wet	some wet sones, some d	ark gray silty clay		
5	SS	18		750-	-		Intribitation interest		CL		more silt, lighter	red-brown			
6	33	18	3 4 6		15-		THE PERSON NAMED IN		CL		oily sheen on san	nple			
7	S S	16	3 3 10	745	-		-		CL		more silt				٠
	58	18	\$ 10 15		-		***************************************	********				firm, slightly shaley, dri gray and dark gray son			
Z F	* 2	H	\$200 300	31 30 E _T	* 5342 * COM		TUBE CI		QUII	wous	SAMPLER	LCAAP Independence	Ma	PAGE NO.	HOLE NO. 16-10

										WALL TO THE REPORT OF THE PARTY	
[E	OL	OG	IC D	RIL	L L	OG P	OJECI	NAM	LCAAP, Independence, Mo.	PAGE NO. HOLE NO. 2 of 3 16-10
SAMPLE NO.	SAMPLE TYPE	RECOVERY *	SAMPLE	elev	DEPTH	GRAPHIC LOG	WELL CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPTION	NOTES
. 9	33	8	49 50/3*	740-	25 -		արժագործանրան արժարդումին արևանականում արդանական արդարանին արդարդումը արդանումը արդանական արդանին արդանին արդա Արժաժանական արդանական արկանին անանանական արդանական արդանում արդանում անդանական արդանական արդանական արդանական ա	ML		SILT: with clay, very compact, firm, crumbly, thinly bedded with dark laminations, semi-dry, light brown, may be weathered shale	. •
10	SS	8	50 44	735	30-		e la fer de la fere de la ferencia de la ferencia de la ferencia de la ferencia de la ferencia de la ferencia d La ferencia de la ferencia de la ferencia de la ferencia de la ferencia de la ferencia de la ferencia de la fe	ML		some thin beds of maroon silt, overall olive-green	
11	SS	4	100/4	730-	35 -		elet tekt teleteke leteke leteke tekt beket beket tekt tekt tekt beket beket beket beket beket beket beket bek	1		SHALE: well sorted, uniform texture, semi-hard, blue-green	
	SS	0	50/0*	725-	40 1 1	· · · · · · · · · · · · · · · · · · ·		Sh		same as above	
*A3 58	TM = \$) 15. PL 11	SPOC	ST SM C	= SHEL = CORE	THGS	USE CS = C	ONTIN	luous	SAMPLER LCAAP Independence, Mo.	PAGE NO. HOLE NO. 2 of 3 16-10

GEO	DL										
		UGI	C D	RIL	L L	OG	OJECT	NAP	LCAAP, Independence, Mo.	PAGE NO.	16-10
1											10-10
SAMPLE NO.	RECOVERY "	SAFFLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	SAMPLE	DESCRIPTION	МО	TES
			720-	45-					observed cuttings 39.0 - 64.0 feet SHALE: silty, variable hardness, uniform grain size and texture, blue-green		
ст		·	715-	- 50 - -			Sh		same as above		
			710-	55					same as above		
CT			700	- 60 			Ĺs		LIMESTONE End of boring @ 64.0 feet		
*ASTN \$8 = \$ D = D	158 111	\$200	N Ç	= CUI		CS = 1	CONTIN	luous	SAMPLER LCAAP Independence, Mo.	PAGE NO.	

													1	M						7				
6	JE	O	LOG	iK E	RIL	LL	.OG	78.0	JECI	HA	E AND L			Indene	nden						PAGE		HOLE I	
1	ART			150 / 4 / 90	DRIL		111		- 1				1	BORENO		ce, Me	۳	ELL D			1 1 01	OTA	L DEPTH	-
to	(3			4/88	10		-Wes	ELEV	-	GROUN	iner-D D ELEV	TIOI	500	DEPTH/E	8" LEVAT	ion ero		ATER		E HEA			<u>(3.00'</u>	_
		<u>P.</u>	Bart	z	<u> </u>		<u>55.06</u>				762.	90				43.	15'	719.	75°	6/1/	88			
SATPLE NO.	SAMPLE TYPE		SAFFLE	ELEV	DEPTH	GRAPHIC LOG	7737		CLASS- IFICATION	SAMPLE				DES	CRIP	TION						NO.	TES	
1	SS	14	8 13 15	760-	5-		antantantantahin	**************************************	CL			grain s	sise, s rown,	emi-mo abunda	ist, fir	d, unifor m, semi- ck meta	-pla	stic.						
2	33	17	7 8 11	755-	10-				CL		more si	ilt, ver tan-br	y fira rown,	n, less p olive	lastic,	no conc	retic	ons, lig	thter					
3	SS	18	7 9 12	750-	15 –				ZL		very sil	lty, buí	æ									-		
	38		29 29 50/3	745				O CONTRACTOR OF THE O	ı		semi - bı	rittle, 1	very (iense, sc		d-brown	a mo	ttling						
	8	LI)	3700	Ę	99	IMOS	Si :	CON	IIM	IOUE :	SAMPLER			Ind	LC epen	AAP deace,	M) .		Ī	PAGE 1		HOLE N 16-1	

G	E	OL	OG	IC D	RIL	Ll	.OG	Pile	JEG	100	LCAAP, Independence, Mo.	2 of 3	NOLE NO. 16-11
SAMPLE NO.	SAPPLE TYPE	RECOVERY "	SAFFLE	ELEV	DEPTH	GRAPHIC LOG	1194		CLASS- IFICATION	SAMPLE	DESCRIPTION	но	TES
				740-	•			telytytelytytytytytytytytytytytyty			same as above		
	SS CT	3	50/3*		25 -		ંકાનુકાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું કાર્યાનું 		Sh Sh		SHALE: uniform grain sise and texture, thinly bedded, crumbly along bedding plane, semi-weathered, dry, gray, occasional thin brown beds	:	
				735	30 -						maroon colored 30 - 31 feet ·		
	CT			730-	- 35 -	THE REPORT OF THE PROPERTY OF	*****	istolista istolista oli salaina salaina salaina salaina	Sh				
				725-	- - - 40-	医唇唇唇及性性炎 医原体性					shale becoming harder, also observed small globules of oil in drill mud		

GE	OL	OGI	C D	RIL	L L	OG	(O)EGI	N/J	LCAAP, Independence, Mo.	PAGE NO.	16-11
SAIPLE TYPE	RECOVERY "	SAMPLE BLOUS [†]	ELEV	DEPTH	GRAPHIC LOG	MELL SONSTRUCTION	CLASS- IFICATION	SAPPLE		NO:	TES
CT			720-	- 45 -	All Residence of the second se	Ā	Sh		olive green-gray		
			715-	- - 50-						•	
CT			710-	55 -			Sh		Observed cuttings 24.0 to 61.0 feet		
СТ			705	- 60 -	And the second of the second o		L		LIMESTONE: massive, hard, gray		
			700						End of boring 63.0 feet		

							الفارية الأ	سور ن	, jj.,		WEST		·	
GE	OL	OG	IC D	RIL	LL	OG	PIK	DEC	T NAME	I CAAP	Independence, Mo.		PAGE NO.	16-12
STAIT		FIR		DAIL	H			- 1	DRILL	HETHOD	SCHEHOLE STANETER	VELL DIAMETER	TOTA	L DEPTH
1/23		1/3	27/88	Le	yne	- Wes	ter:	-		B-61/HSA B ELEVATION	12" DEPTH/ELEVATION GROU	4" PVC		32.00'
		lenne	ett			6.17				773.80	ł	5'/759.65' 6/1/		
SAMPLE NO.	RECOVERY "	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	חברר	CONSTRUCTION	CLASS- IFICATION	SAMPLE	·	DESCRIPTION		но	TES
1 55	3 18	7 22 14		•		isticialists stated states stated stated		PILL		FILL: clay with very stiff, red-brown	race silt, abundant carb moist, abundant oxidise I	onised nodules, d staining,		
2 35	5 18	8 14 15	770-	5-			hilidalidalidalida			trace fine gravel				·
3 85	18	5 7 9				3	3	CL		CLAY: well sorte mottling,	ed, trace silt, low plastic red-brown	ity, moist, trace		
4 8	3 18	5 6 8	765	10-				CL		more moist and	blastic			
5 55	1.6	9 11						CL		trace lignite frag	ments and roots, less mo	pist and plastic		
6 33	3 18	5 9 14	760	15-		¥		CL		trace gravel, bec very stiff,	omes layered gray and b may be claystone or we	rown, becomes athered shale		
7 55	18	17 35 46				100		Sh		SHALE: same ch and brown	naracter as above, more on	cohesive, firm, gray		
		45 50/3		- 100				Sh		Gray			PAGE NO	. I HOLE NO.
38	21	1 390	ON Č,	89) Inc	Ş	* C	ONTI	MOUS	SAPLER	LCAAP Independence	Mo.	1 of 2	

										WEST N		
GI	E()L(OG	K C	RIL	LL	og ľ	NJEG	TOUR	LCAAP, Independence, Me.	2 of 2	16-12
SAMPLE NO.	SAMPLE TYPE	RECOVERY *	SAFFLE		HT430	GRAPHIC LOS	PONSTRUCTION	CLASS- IFICATION	INTERVA	DESCRIPTION	NO	TES
9	33	2 (50/6*	750	25-			Sh		SHALE: fine, well sorted, fissile, light gray		
10 5	33	2 5	io/2*	745	30 -			Sh		same as above End of boring @ 32.0 feet		·
AS 11	S/	150	SPCC	87 10 27	• 500 • COR • CUT	LBY	CS :	CONTI	uous	LCAAP Independence, Mo.	PAGE NO. 2 of 2	

_)L		K D			OG			_	LCAAP,	Independence, Me.		PAGE NO. HOLE NO. 1 of 1 16-13
STA			7181		ORILI		We		- 1		ATV/HSA	IONEROLE DIAMETER 10"	WELL DIAMETER 4" PVC	TOTAL DEPTH 20.00°
	24/ Œ1		11/4	4/88	La	7 0	STRE	ELE	. 1	atoui	D ELEVATION	DEPTR/ELEVATION GROU		SURED 20.00
	R	<u>.</u> B	enne	tt	<u> </u>	_ 77	5.40	0	_1		773.38	7.83	3'/765.55' 6/1/	88
SHIPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	御上服 り	DEPTH	GRAPHIC LOG	TIEST PROPERTY OF THE PROPERTY	CONSTRUCTION	=	, ,		DESCRIPTION		NOTES
1	SS	8	12 20 30					րերերերերերերերերեր	Pill		FILL: clay, trace trace mot	fine gravel and roots, viling	ery stiff, moist,	
2	33	14	6 8 8	770	5-						abundant lignite	fragments, gray and bro	own	
3	33	18	4 4 5		•		Ž	Z	CL		CLAY: well sorte	ed, stiff moist, trace mot	tling, red-brown	
4	SS	18	4 4 3	765	10-				CL		moderate plastic	ity, wet		
5	33	0	3 3 4					-	CL					NO RECOVERY
6	5 5	18	2 3 3	760-	15-				CL		abundant lignite	fragments, gray		
7	35	18	7 6						CL		trace silt, moist	io wet		
•			1						CL		SILTY CLAY: a plasticity gray	bundant silt, trace fine ; , very moist, some oxida	gravel, moderate tion and mottling,	

GE	OL	OG	IC D	RIL		OG	PROJE		LCAAP, Independence, Mo.	PAGE NO. HOLE NO
1/20	/88	1	20/88	1		-West	era		3-61/HSA 12" 4" PVC	17.50
deser R		enne	ett	100		1871112 EI 10.05	EV.	atou	737.45 DEPTH/ELEVATION GROUNDWAYER - DAYE 11.91'/725.54' 6	
				<u> </u>						
SAMPLE TYPE	RECOVERY "	SAMPLE	elev	DEPTH	GRAPHIC LOG	WELL		IFICATION SAFEE INTERNAL	DESCRIPTION	NOTES
1 33	10	2 5	735-				blokelishishishishishishishishishishishishishi		TOPSOIL: silt, clay, humus, roots, moist, dark gray	
2 53	12	2 2 3		5-						•
3 53	18	2 1 3	730	•			CI		CLAY: trace silt, fine gravel and lignite fragments, moderate plasticity, saturated, some mottling, dark gray to black	
4 55	18	2 1 1		10-			CI		some thin silt lenses, saturated	
5 53	18	2 2 1	725				CI		no gravel, saturated	
58	18	2 2 1		15-			CI		abundant lignite fragments	
7 38	18	2 2 2 2	720-				CI		some silt, no lignite, saturated	

											WESS			
GE	<u> </u>	OG	IC D	RII		OG	PRO	JECT	HAVE	AND LOCATION				HOLE NO.
START		TPIN		TORTL			Ь.	7	MILL	HETHOD	Independence, Me SUMERICLE DIAMETER	WELL DIAMETER	1 of 5	17-8
1/24	/88	1/3	26/88	La	yze	-We	tern		Gard	mer-Dave 500	8" DEPTH/ELEVATION ON	4" PVC		86.00'
LOGGE		Bart	2	100		60.04		٠ ١		737.45		67'/726.78' 6/1/		
				1										
SAFFLE NO.		SAMPLE	ELEV	DEPTH	GRAPHIC LOS	WELL	CONSTRUCTION	CLASS- IFICATION	SAMPLE		DESCRIPTION		NO	TES
1 54	18		735 · 725 · 720 ·	10-			while following the property of the property o	CL		SILTY CLAY: w	cil sorted, some brown	mottling, soft, very	PAGE NO.	. (HOLE NO.
*ASTA	SPL I	\$ 9 0	31 30 C	200	ine	CS S Of	: 00	MTI	NOUS	SAIPLER	Independenc	e, Mo.	1 of 5	

G	E	OL	OG	IC D	RIL	LL	.OG	PR	JECT	NAM	LCAAP, Independence, Mo.	PAGE NO. 2 of 5	1
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	BANPLE	ELEV	DEPTH	GRAPHIC LOG	WELL	100 LOOK 1000	CLASS- IFICATION	SAMPLE Interval	DESCRIPTION	N	OTES
3	33	18	5 11 11	715-	25 -		પ્રતિકૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના કૃતિના ક		CL		very silty, silty sand lense at 24.5', very soft		
3	33	6	1 2 2	710-	30-	\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	કો કર્મકારો છે. તેરે છે. તેરે છે કે પ્રાથમિક પ્રાથમિક કરો છે. 		SM		SAND: medium, well sorted and rounded, abundant silt, grades to clean sand at 29.0', wet, loose, gray		
4	SS	6	12 12 14	705	35-	de de la companya de la companya de la companya de la companya de la companya de la companya de la companya de			SM		trace small pebbles		
5	SS	8	14 26 26	700	- - - 40-	֓֓֞֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓			SM		SAND: medium, well sorted, abundant silt, trace of fine gravel, saturated, medium gray		
7A5 55	114 S) 158 PLJ [SPOX	37 W C	SHE	WY I	CS	χ	MITH	vous	LCAAP Independence, Mo.	PAGE NO	

WEST CONTROLLER

												7	X	居	VI						
9	iΕ	OL	OG	IC D	RIL	LL	OG	PROJEC	T HAVE	E AND LO			deper	adonce	Mo.				AGE NO.	HOLE 17-	
SAMPLE NO.	INPLE TYPE	RECOUERY *	SAFFLE	ELEV	DEPTH	DRAPHIC LOG	MOLLOWELENOS	CLASS-	SAFFLE				DES	CRIPTI	:ON		, _		NC)TES	
	35		11 13 8	695	45-			SM SM		SAND:	mediu and w	ım, we	il sorte undan	d, interl	ayered vursted,	vith bed medium	e of fin	10			
7	5.5	S	17 24 24	690	- - 50-	1.01.01.01.01.01.01.01.01.01.01.01.01.01				same se	above	e, tracc	e of fin	e gravel							
8	53	12	18 27 21	685	55 -		臺			SAND:	iame :	as abo	· vve, find	e grained	ı						
9	58	5	13 14 18	680-	60 -	elegigeigeigeigeigeigeigeigeigeigeigeigeig				SAND:	mediu race li	im to c ignite :	coarse, aliuviu	moderat m, loose	ely sort , wet, gr	ed, som ay	e grave	d.			
10 A3	58 114	7 215	12	675- 31 38 C.	COR		300	ew CONTI	E	SAND :	and Gi	RAVE	nts, loc	ree grain nee, wet, LC/ lepend	Grey AAP		d, trac	ł	PAGE NO.		

G	E	OL	OG	IC D	RIL	L LOG	PROJI	CT N	LCAAP, Independence, Mo.	PAGE NO. NOLE NO. 4 of 5 17-8
SAMPLE NO.	SAMPLE TYPE	RECOVERY	SAMPLE	ELEV	DEPTH	GRAPHIC LOG	CLASS-	SAMPLE	DESCRIPTION	NOTES
			iŧ		65 -	نۇرۇرۇرلۇرلۇرلۇر ئۇرۇرلۇرلۇرلۇرلۇر			see above	•
11	33	3	17 21 9	670-	- - 70-	in a chairte an an an an an an an an an an an an an	SV	v	more gravel	
12	33	7	15 21 20	665	75-		S.	•	SAND: medium to coarse, moderately sorted, trace gravel, subrounded, loose, wet, gray	
13	S 5	18	6 5 11	660-	80		MI	L	SILT: well sorted, thinly bedded, semi-soft, semi-moist, gray	
14	38	6	20 13 11	655	85		MI	L	with some coarse sand and gravel, medium to coarse, wet, gray	
7A5 35	IN C	7158	\$200	ST CT	SHEL	INGS OF	CONT	Innon	LCAAP Independence, Mo.	PAGE NO. HOLE NO. 4 of 5 17-8

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G	iΕ	OL	OGI	IC D	RIL	LL	og ["]	ROJECT	NAM	LCAAP, Independence, Mo.	PAGE NO. 5 of 5	HOLE NO. 17-8
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SANFLE	ELEV	DEPTH	GRAPHIC LOG	MELL	CLASS- IFICATION	SAMPLE	DESCRIPTION	но	TES
										Interbedded LIMESTONE and SHALE End of boring @ 36.0 feet	PAGE NO.	MOLE NO.
\$\$ 0	= \$i		\$200a	Ę	COR	INGS	CS =	CONTIN	uous	SAMPLER LCAAP Independence, Mo.	5 of 5	17-8

)L	_	C D			OG	PR			AND LOCATION LCAAP, Independence DIAM BOREHOLE DIAM	e, Mo.		PAGE NO. 1 of 2	17-9
ITA 1 / 1		22	1/2	31 2/88	DATE		-Wes	ter		-	-61/HSA 12"	ELEX MELL	DIAMETER 4" PVC		0.50'
ÓG	Ç.I				100	of CA	STRE	ELE	7.		ELEVATION DEPTH/ELEVATION		· DATE HEAS	URED	.0.50
	R	. В	<u>enne</u>	<u>tt</u>	<u>L</u>	74	8 .60				746.10	7.23'/738	.87° 6/1/8	38	 _
SAPPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE	ELE V	DEPTH	DRAPHIC LOG	WELL	CONSTRUCTION	CLASS- IFICATION	SAMPLE	DESCRIPT	TION		NO.	TES
1	SS	5	3 6 8	745	•			ել հոյինը հեղանինը իր իրի ինդին և հեղինի իրինի հեղինի իրինի իրինի իրի	OL		TOPSOIL: clayey humus with so moist, dark brown to blace	ome roots, well a	orted,		
2	33	6	3 4 5		5-	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4144444444444	իկիլիկիրիկիրիկիրիկի	CL		CLAY: well sorted, trace lignite moist, trace mottling, red	fragments, low -brown	plasticity,	٠	
3	SS	16	2 3 2	740		The Control of the Co	₹		CL		same as above				
4	3 3	18	1 2 1		10-	X			CL		moderate to high plasticity, satu	rsted			
5	3 3	18	2 2 2	735-					CL.		SILTY CLAY: well sorted, high protecting, red-brown	pl as ticity, satur	ated, some		
6	3 3	18	2 2 3 3		15-				CL		abundant lignite, medium gray				
7	58	18	4 4 6	730					CL		same as above				
•	5 5	18	5 7 10						CL		trace mottling				

									WEST OF THE PROPERTY OF THE PR		
GE	OL	OG	IC D	RIL	LL	OG	OJECT	NAM	LCAAP, Independence, Mo.	PAGE NO. 2 of 2	NOLE NO. 17-9
, u	Ι.	ı	Γ	Γ	9		Τ_	<u> </u>		<u> </u>	
SAMPLE TYPE	RECOVERY	SAMPLE	elev	ОЕРТН	GRAPHIC LOG	WELL	CLASS- IFICATION	INTERVAL	DESCRIPTION	NO1	ES
									End of boring @ 20.5 feet		
										•	
						·					
	215			a <u>S</u> jari	V				LCAAP	PAGE NO.	HOLE NO.
• •	PLIT	SPOC SON	W Č	= SHE = COR = CUT	1 mas	C\$ = C	ONTIN	uous	Independence, Mo.	2 of 2	17-9

											,	WEST			
G	F	<u> </u>	OG	IC D	RII	LL	OG	PR	DJECT	WAR	E AND LOCATION				HOLE NO.
57A			INIT		DATE			1	Į0	RILL	HETHOD	Independence, M. BOREROLE DIAMETER	O. WELL DIAMETER	1 of 2	17-10 AL DEPYN
1/:	26/	/88	1/2	6/88	La	yee	-Wes	ter		ATV	(CME)/HSA	10"	4" PVC		28.00'
	_		Bartz	<u> </u>			8.14				745.40		97'/725.43'_ 6/1		
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE BIOUS*	ELEV	DEPTH	GRAPHIC LOG	TIEM	CONSTRUCTION	CLASS- IFICATION	SAMPLE		DESCRIPTION		NC)TES
				745-	5						FOR INFORMA GEOLOG	FION FROM 0 - 15 F IC LOG 17-9	EET, SEE		
	55		11 14 17	730-	15 -				CL		mottled re semi-plast	sil sorted, abundant si d-brown and gray, see ic, semi-moist	mi-firm,		
-V21			2700	N Ç	- 25	PT 1	Ċ.	• Q	MIIM	vous	SAIPLER	LCAA! Independenc	, <u>-</u>	PAGE NO.	

										WASTERN !		
6	E	OL	OG	IC D	RIL	LL	OG	OJECT	WATE	LCAAP, Independence, Mo.	PAGE NO. 2 of 2	HOLE NO. 17-10
Γ												
SAFELE NO.	SAMPLE TYPE	RECOVERY	SAFFLE BLOUS*	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS- IFICATION	SAMPLE	DESCRIPTION	NO	TES
2	35	18	7 10 13	725 - 720 -	25-			CL		more mottling and carbonised wood fragments LIMESTONE: fissile, hard, gray End of boring @ 28.0 feet	•	
*A4	714) 5 	spor	31 34 €,	s SHE	. 5Y	CS =	CONTIN	NOUS	LCAAP Independence, Mo.	PAGE NO.	NOLE NO. 17-10

G		OL	OG	IC D	RIL		OG	PROJE		LCAAP,	Independence, Mo.	LIELL DIAMETER	1 of 5	HOLE NO.
2/	7/	88		8/88 -	1		-West	ern	Gard	iner-Davr 500	. 8.	4" PVC		94.00°
.06	e I		Bart	2	100		181116 E 19.26	LEV.	GROUN	737.40	DEPTH/ELEVATION GROU	1'/724.99' 6/1/		
								-	<u> </u>					
SAMPLE NO.	SAMPLE TYPE	RECOVERY "	SHAPLE	ELEV	DEPTH	GRAPHIC LOG	WELL	CLASS-	IFICATION SAMPLE INTERVAL		DESCRIPTION		МО	TES
1	9 \$	12	3 8 9	735-	- - - 5-					SILTY CLAY: w uniform to dark gray	ell sorted, abundant silt xture, stiff, some mottli	and roots, ing, semi-moist,	•	
2	58	17	\$ 6 7	730-						same as above				
3	\$ \$	18	1 1 2	725-				M		sand, abui	poorly sorted, some clay idant roots, increased si ling, very moist, Cark g	it at 15.0', soft,		
•	52	17	4 8 1	720-	-			CI CI		SILTY CLAY: m	oderately sorted, semi-i ling, gray	firm, semi-moist,		

GE	OL	OG	IC D	RIL	LLO	G		NAME:	LCAAP, Independence, Mo.	PAGE NO. 2 of 5	18-7
SAMPLE TYPE	. 1 🚟	BLOUS	ELEV	HT430	8	CONSTRUCTION		SAFFLE	DESCRIPTION	NO:	res
5 SS	18	223	715-	25 -	44444	स्त्रीर किन्त्री क्षेत्रिको निर्मा किन्त्री किन्त्री किन्त्री किन्त्री किन्त्री किन्त्री किन्त्री किन्त्री किन			interbedded CLAY and SILT: semi-soft, moderately sorted, very moist, gray		
6 55	10	3 16 31	710-	30 -			SM		SAND: clayey silt grades down to fine sand, well sorted, rounded, loose, wet, gray		
7 55	3	11 20 24	705-	35-		3			interbedded SILT, CLAY, and SAND: thinly bedded, all soft, wet, gray, with abundant woody plants		
SS	14	9 9 13	700-	40-			SM		SAND: fine, well sorted, rounded, loose, wet, green-gray		

								PR	OJECT	NAM	TAND LOCATION	PAGE NO.	HOLE NO.
G	E	OL	<u>OG</u>	IC D	RIL	LL	. <u>OG</u>	_			LCAAP, Independence, Mo.	3 of 5	18-7
SAMPLE NO.	SAMPLE TYPE	RECOVERY *	BLOUS!	ELEV	DEPTH	GRAPHIC LOG	133	CONSTRUCTION	CLASS- IFICATION	SAMPLE INTERVAL	DESCRIPTION	МО	TES
9	33	8	11 20 24	695	45-		ing and inglication in the interpretation	*************************************	SM		SAND: fine, well sorted, saturated, green-gray		
10	58	3	10 19 23	690-	50-			જ કો જો તે માં માના માના માના માના માના માના માના	SM		same as above	-	
11	SS	0	22 23 31	685	55 -				SM			NO REC	overy
13	58	9	38 23 27	680	60-		1		SM		SAND: fine to medium, well sorted, trace of coarse sand and fine gravel, saturated, medium gray		
13 *A\$	58 TH	75.5	22 3200	675	= SHEL	J		THE PERSON OF	SM	uous	SAND: fine to medium, fairly sorted, abundant lignite alluvium, trace large gravel, saturated, gray LCAAP Independence, Mo.	PAGE NO.	HOLE NO. 18-7

											WEST OF THE STATE		
G	E	OL	OG	K D	RIL	LĮ	.OG		OJECI	T DUR	LCAAP, Independence, Mo.	i i	LE NO. 18-7
SAMPLE NO.	SAMPLE TYPE	RECOVERY "		elev	HTHE	GRAPHIC LOG	7-1395	CONSTRUCTION	CLASS- IFICATION	SAPPLE	DESCRIPTION	NOTE	3
			19	670-	6 5 -						see above		
14	33	11	23 25 27		- 70- -				SM		same as above	-	
15	38	6	10 20 21	665	- 75 -				SM		fine to coarse, trace lignite and fine gravel, very fine sand at 75.0°		
16	35	18	1 1 7	660·	80-				CI.		CLAY: well sorted, plastic, very uniform texture, semi-soft, very moist, gray, becomes silty at \$0.0°	•	
17	SS	10	14 18 26	655-	85 -				SM		SAND: fine to medium, poorly sorted, abundant lignite alluvium, trace limestone fragments, loose, wet, gray		
A SS) 5 	\$ 2 00	31 38 G	• CON	LIV	TURE		CONT I	NOUS	LCAAP Independence, Mo.		ULE NO. 18-7

										WEST TO THE PARTY OF THE PARTY	-	
G	E)L	OG	IC D	RIL	LL	OG	OJECT	HAPI	LCAAP, Independence, Mo.	PAGE NO.	NOLE NO. 18-7
-												
SAFFLE NO.	SAMPLE TYPE	RECOVERY "	SAMPLE		DEPTH	GRAPHIC LOG	CONSTRUCTION	CLASS- IFICATION	SAFPLE	DESCRIPTION	NO	TES
18	55	9	4 6 55/3	650-	90-			SM		fine, well sorted, trace lignite alluvium, subangular, tightly packed, wet, gray		
19	33	3	50/3	645	- -			SM		weathered surface of quarts and limestone rock LIMESTONE: hard, massive, fractured, gray End of boring @ 94.0 feet		
7A3	8	Ü	SPOC SCH	W CT	= SHE = COR	INC	CS =	CONTIN	uous	LCAAP Independence, Mo.	PAGE NO.	

WELL CONSTRUCTION RECORDS OF PREVIOUSLY EXISTING LCAAP WELLS

MW16-3 EA ENGINEERING. SCIENCE AND TECHNOLOGY, INC. USATHAMA THA57132 LCAAP eame no. ORILLING WETHOOK HOLLOW S FEM AVOSE 86-03 LOG OF SOIL BORING 12° 0.0. 6.5° 1.0 CMB 55 RIG .2 Co-ordinates: SAMPLING WETHOD: STEW D. PENGTRATION 735 - 18 driven solit soon-tod OMILLING Surface Elevation: 10 16 hamme Last 30 START FINISH Casing Above Surface: WATER LEVEL | B. 45 | B.C.I | Reference Elevation: Reference Description: Mark on PEC 150 1145 1305 15151 3-16 DATE 5-4-96 5-9-96 REFERENCE | REF | REF | 5-8-46 5-3-36 SUPPLE CONCITIONS Lik - near trop GHAPING CHIPPIRMA Ffm Maist still clower silt tock fire sand ML K diren 0 1.0 Δ 45 0 sand. ML olive a raw bourn HO on mode B.O'- Water I polire into aver 3/50.5 MI Not solt clause selt, trace two sand MI 0 Z Park Tiellowish brown - 104R412 X Ž 5 145 Wet very Solt claren sult. tr. I same M SPT 0 Dade yollowish traven' 11 VR AN

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C-81 SHEET

							[.08 :	<u> </u>	CLENT	MW 16-	LOCATION	
		SCE	IGINEE IGINEE	Fing No			726	45/BZ	US	ATHEMA	LCAR	2 <i> </i> -
_		TEO	NOLO NOLO	GY, IN	C			-			BORING	~ 0.
	LOG OF	SOIL BO	RING						·		86	-0
											S+(£7	
1	Co-ordinat	:4:					SAMP	UNG WETHOD	<u>* </u>		2	
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İ		ove Surface: Elevation: _					WATE	to Level	<u> </u>		START	+
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- Contraction		a /	101	سخد	<u>! </u>							
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	ST 7.5	25/2	4		FF		91000 2.31 3.0.4	M- 01.2€	May - 5 13.	Sy 5/2	י ברוצה	'ed
	ST 7.5	25/2	4		FF		Prèce Zist 3.0. Hi Fini	ht of it	tray- 5 13. simpling	Total 2 pe	, conin	
	57/1.5	25 %			FF		Prèce Zist 3.0. Hi Fini	15 01,20 12 2 2 1 13 2 4 50	tray - 5 13. sumpling ten: screen	5x 5/2 0. Samplin @ 930	, only	(
•	ST 7.5	25 %	4		7 8 9		Pière Zisi 3.0. Hi Fini Woll	mstella	tun: screen	A DE DAR	= 25.5	(
1	ST 7.5	25 % 	4	0	FF		Prèce Zist 3.0. Hi Fini	metale metale	tun: screen	5x 5/2 0. Samplin @ 930	CZS.S	
	ST 7.5	25 % / / / / /	59 &		7 8 9		Price Zist 3.0. Hi Find Well /	metale metale	tun: screen	Total 2 pe	= 25.5 = 0.5'	
			59 2		30 1		Price Zist 3.0. Hi Find Well /	metalic metalic metalic metalic med nu	transing screen	Total a per 100 ce up 100 ce up	= 25.5 = 25'	e de
		25 % / / / / / /	59 &		7 8 9		Price Zist 3.0. Hi Find Well /	metalic metalic metalic metalic med nu	screen screen to august asal s	Total a per 100' plus ce up 10 ce u	= 25.5 = 25.5 = 25.7 = 25.5 = 25.7 = 25.5 =	Lu an
			59 2		30 1	•	Price Zist 3.0. Hi Find Well /	metalic metalic metalic metalic med nu	screen screen to august asal s	Total ape 100' plus ich up 100' plus ich up no En 10 augh 200 ark perh	= 25.5 = 25'	Lu an
			59 2		7 8 9 1 2 1	•	Price Zist 3.0. Hi Find Well /	metalic metalic metalic metalic med nu	screen screen to august asal s	Total a per 100' plus ce up 10 ce u	= 25.5 =	
			59 2	0	7 8 9 1 2 1		Price Zist 3.0. Hi Find Well /	rel so	screen screen	Total age 100' plus	= 25.5 =	Lu man in 2 mil
			59 2		7 3 1 2 3 4	•	Price Zist 3.0. Hi Find Well /	rel so	screen screen to august asal s	Total age 100' plus	= 25.5 =	Lu man in 2 mil
1044			59 2		7 8 9 1 2 1	•	Price Zist 3.0. Hi Find Well /	rel so	screen screen screen to august asul s use	Total age 100' plus	= 25.5 =	
104					7 3 1 2 3 4	•	Price Zist 3.0. Hi Find Well /	rel sur	screen screen screen to august asul s use	Total age 100' plus	= 25.5 =	
1044			59 2		7 8 9 1 2 3 4 5	•	Priore Priore Tist Tist	metalla met	transing screen screen to state asul s usel f screen asul s usel f screen asul s con to 30 con to	Total Dear 100' plus Total Dear 100' plus	- 25.5 - 25.5	
104			55 2		7 3 1 2 3 4	•	Priore Priore Tist Tist	rel sur	transing screen screen to state asul s usel f screen asul s usel f screen asul s con man asul s	Total age 100' plus	- 25.5 - 25.5	
104					7 8 9 1 2 3 4 5	•	Priore Priore Tist Tist	metalla met	transing screen screen to state asul s usel f screen asul s usel f screen asul s con man asul s	Total Dear 100' plus Total Dear 100' plus	- 25.5 - 25.5	

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MW16-5 100 10. EA ENGINESTING. SCIENCE AND TED-INDLOGY, INC. USATHAMA LCAAP THASIBZ BORING NO. HSA - 12"0, D 65" 10 DRILLING WETHOD: 86-05 LOG OF SOIL BORING CHE 55 Section Co-ordinates: _ 0 Z SAMPLING WETHOO: Stand Par. Tost 18" 375 Solit soon ORIGINAL STREET Surface Elevation: hammer Lalling 30 START FINISH 20 Casing Above Surface: __ WATER LEVEL 19.82 Reference Elevation: ٠ ښ Reference Description: Mark on DVC 21M 0800 1215 TIME 1600 SATE 5-9-86 54.95 5-9-96 REFERENCE 125 SURFACE CONCITIONS: BLOWS/8 IN. 上海士 CHATING noon 12:00 1111 N alin 200 M015445-1++ trace cisomo tr 127 FILL 10 sami 1.0 11 ST 1.5 4.5 MUST vory STIFF clayer SIH, trice. I. sond 5 ML MINC, brun X gram SPT 1.5 9.5 Moist manium still down on silt. Low Line MC Sand whose blue Liebot alive atom DID asitue reading in hele or cirria ON SOURT @ 14.0' ~ 14.5 5.5 16 CL Most hard Clare highly wantaged chal Ä 70 MA BAL water bearing Cered of L Sinte CA ndianein while running record 19.0' C-85 NEXT SHEET

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l	Co-o	rdinate	s:							SAMPLING WET	HOO:	······································			72	ے ی
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LOG OF SOIL BORING			87-62
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SA ENGINEERING. SCIENCE AND TECHNOLOGY, INC. HSA . 9220 621.0 יסטירדשי שאנבותכ LOG OF SOIL BORING ALL-TERRAIN 2n SGT. 15 Solit soun -Co-ordinates: . HILLIAND CONTHE LANG-LAKSTOCK dictant and aurob (C. 171 app. 15) Surface Elevation: failure 300. START | PINISH Casing Above Surface: 11261 1.4 | 8.62 | 8.74 Reference Elevation: . Reference Desnation: Mark on 30 of PVC Casine 1525 10750 10725 0135 1355 1530 JATE 1-27 1-23 Ten Byreck REFERENCE | SURF | SUZF | ZES | REF 11-15-57 1-25 SURFACE CONCITIONS: SAMPLE BINDWS/G III Jastur GHAPING 11111 /[Pork wellowish grown moist day and silt 100 x 2/2) (3251) (TOP SOLE) CL 0 57 10/6 ٥ 0 Z Brownish arong moist silta 0 4 /modium 5 X Dive arous Maist (DASSIDIL 62-11 And LATTA C'CA) C 0 (57 42/2) /mon 10 " DA CHICKISTANE V HOU GE STHOP 14.5 <u>ر پ</u> met silten Olive gene c/200 SPT 18/15 0 1/5/3/1) Water in ausurs contat: Ctan to solt int copt aradational

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EA ENGINEERING. SCIENCE. AND TECHNOLOGY, INC. 0 SETISPMA LCAAP / FREE E THE SIBS SPILLING WETHOD: #54 87-03 LOG OF SOIL BORING inci? Co-ordinates: _ 202 SAMPLING METHOD: SHILLING Surface Elevation: START - FINISH Casing Above Surface:. MATER LEVEL Reference Elevation: TME Reference Description: BIAC DATE REFERENCE ! SURFACE CONGITIONS: SAMPLE IN SAMPLE DLFTH OF CASING Granish arm wet classes silt some mederate ML ź SPT 18 42 Mowish (1042 5/4) mothers (ML (5GY 5/1) 0 18, 20 Conedius 3 to 25' and Sample wet medium to Line sand trace \$1/6 MOLF 0 18/25 16/26 (54 4/1s (come longe) SW SPT somas (WELL INSTALLATING DETRILS: Stewn : 1-21-97 1420 1545 Finish. 30 Strakera -2.5 Gmu+ : Sept 2.5 Bendarit : 2.547.5 E Send in to: 75 to 25.0 30W @ 23.0 Seresa · 12.5 + 22.5 Casina: 150' (10.5'=50' sight ins) scren : , lug 111.5 021 Lale - No Covine Hor selline notective casing 1540

4W18-Z ea engineeting. Science and THE SIBS lcarp/reer E SMILLING WETHOO: HSPA . Hollow SHEPA LOG OF SOIL BORING 87-04 1313 CME 750 Tomin Zie SPERT Co-ordinates: .. SOT - Store Bon Tost 1 = 2 HALLING CHAIN LAME-WESTERN 18° 501.75 2ma/2° 10 18° 10) dein bu s SAILUNG Surface Elevations 19013 homemor free fallin 300 START | FINISH Casing Above Surface:_ WATER LEVEL 12.2 7.93 17.83 Reference Elevation: . Reference Destriction: Mark on 30 of DVC Course 1/0/010740 08351 0000 0925 SAFE SATE 1-27 1-28 SATE REPERENCE SUZE | REF | REF | 1/27-67 1-27-57 Tam Sutles היון נויון אנית GHAPING 7.I.D. 11111 4 Di+h (ppm) Olive black maist (+sosail ð 1342/11 54. 0 500 3 Olive a cong must site clau CL 0 SPT ラル medium |X| 7 Water on the alva ofter de lline T Notes or rate 12 290' 10 3 Olive army moist livet silter clan (CL) with 4 X (544/11/mic. 5+ 0 Some oranae " law the FALLANCE rosichence <u> For</u> bucine? 3 CLIOI. 10 amen and movement allower SOUTH claus 31/4 51.4. (md. still) (10 x 25/4 SOT 19/15 0 1.22-1 CONTRET (CLAS Grains to 3,14 GRADATINA depth

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MW18-2 EA ENGINEERING. SCIENCE AND TECHNOLOGY, INC. THA SIGA USATHEMA LICAP KRS E SCAING NO. שבווות שבדוותם: MSA LOG OF SOIL BORING 87-04 2 。 ユ Co-ordinates: . SAT SAMPUNG METHOD: SHLLING Surface Elevation: START | PINISH Casing Above Surface: WATER LEVEL Reference Elevation: TME Reference Desription: ļ SATE REFERENCE ! SUPPACE CONSITIONS BAMPLEN GHAFING 1000 CASING P.1.2 HIN LINE CONTR (22m) Dive am clamen silt ML 0 (TY3/1) (Vary Sift SPT 2 SPT 18 235 Granish aron wet self trace fine sound ML 0 1564511 13tift) Augered 25.0 -Batton of Hule 0 75.0 Well In the Martine Pullad magena - relad stanos DAME - AN CAVING Start 10629) 1015 Faich: 1.22-97 2.5 Sichus: 30 Suchel to 2.5 Bondonil : 2.5 to 7.5 Somi nuch: 15 is 25 1 125 6225 Sociar 3011-23.0 150' (10 . 5' <0 - +in casina Sour -105 11/0 Set projective casin a 1110

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MW18-3 ea engineeting. Science and Technology, Inc. USATHEMA THA 5/134 LCARPAZER E SGRING TO. AZY : COMEN SALLING 87-05 LOG OF SOIL BORING SHEET Co-ordinates: . SAMPLING WETHOD: SPT 2 = 2 DAILLING Surface Elevation: START | PINISH Casing Above Surface:. WATER LEVEL Reference Elevation: Reference Destration: TIME ł STAC SAFE STAC REFERENCE SURFACE CONDITIONS H B/SMO III GHAPHIC Modern bluish accomish arm wit self and clam 0 5/ ٥ 1/EV G-55/1 - some but material 20 - moditing 2 3 Mc Merum pluish / across grow not clary 23.5 0 ¥ 5 X Iro som mee 34,200 4 - mid. A 25 Hole 25.0 WELL INSTALLATION: oran hole - pulled مرويس 7-51 April 1500 end: 1-27 1535 Sirkva. 2.5 30 1+,2,5 321-20-1-0 25 4 7.5 7.5 40 25.0 smy care. 125622.5 Strick . 3.0 Ni 23.0 15.3' / (0. 0 = 50' 515 ars) CLSIN SCC210-1-10-5 Slye Ja Lall 255 - Dratector casia installed a 1535 40

MW18-4 ea engineeping. Science and Technology. Inc. TUASIBO CCFAG FREA S ING WETHOO: LOG OF SOIL BORING CME 750 MI 137-06 terrain F1 4 Co-ordinates: . SAMPLING VETHOD! SPT-Standyl Protestia 1 cr 2 Test: SMLLING Surface Elevation: START | FINISH Casing Above Surface: WATER LEVEL | 11.3 10.52 1053 Reference Elevation: Reference Cestination: Marie on 11100 10825 15051 TIME 0930 1050 SATE 11-2011-29 12-3 SAPE on Buther REFERENCE SUFF REFIREF 1-2937 1-29 SURFACE CONDITIONS: خهرمه خ SAMPLEN GHAPING مرے وا 21.0. -3 morth ワニーム (mgs) wellwish brown moust modern still longs ! SPT 0 (1042/2) D ML 2 Duskunelhurish brown moist stiff clansu 514 4 ML (10 Y WZ) 0 6 וומתם כזם fra M 2 3 4 5 6 7 34 Olive som noist (meibly net) med still 10 10 0 411- - ML-154411 IN PAN MORTARIANE 1285FT 97 of wet mud -m auger rise Small smount dillian DODIN WEL A 14.0 Z lolive arm wet your soft a 1+ and claus - Ma 1 SOT 18 18:15 0 16 **□**5M

MW18-4 CLENT SA ENGINEERING. SCIENCE AND TECHNOLOGY, INC. licent/menes THASTISB USATION SCHING VO. SHILLING WETHOO: HSA LOG OF SOIL BORING 87-06 SHEET Co-ordinates: SPT 20 SAMPLING METHOD: SALLING Surface Elevation: START | PINISH Casing Above Surface: WATER LEVEL Reference Elevation: TIME Reference Description: ı SATE SAFE REFERENCE SURFACE CONCITIONS: SAMPLE IN THE STATE OF THE STAT ULPINOT CASING Midante alive brown wor Line and and SII+(SV) 3M 0 154 3/4 11/20 2 SPT 18 235 6/ Maderate alive home wet modulan to time some 0 (573/4) 51/+ 7/2CL 14 لهدسو صديم 5 14/0 13 25.0 Intoll in exclination: - through mours Starte 1100 1.27 Knd: 1225 1-27 30 amtonite. 4 7.5 7.5 4 25.0 12,5 4 22,5 B. J. W # 23.0 RISON 120 + 5,0 Sostano Scroon + . 105 cks 25.5 0-01 - So- Hintertive Craem (a 1225 لے میں WOAL 40 C-99

MW18-5 ea engineering. Science and LCRAPICZETE SCIENCE AND TED-INCLOGY, INC. SMILLING METHOD: HSA - Lhu Sien LOG OF SOIL BORING 750 All-4000 87-07 dr. 11 -Co-ordinates: .. SAMPLING VETHOD: 02 DHILLING CONTH LAYAE - WESTERN 19-10 coliterit(18tac) dava b SMLUNG Surface Elevation: a 160 th hansmer fre-fallin 30" START | FINISH Casing Above Surface: _ WATER LEVEL 1/6.0 10.11 10.32 Reference Elevation: 1520 1630 Reference Description: MARK ON TOP 18 710 Casine TIME 11640 0745 1515 11-23 1-29 2-3 SATE 1-28-37 1-23-57 REFERENCE | SULF | REF | SURFACE CONCITIONS: SID (PPM) GNATHIC 110011 D. 4-6 13" Parkuellawish brown moist clamin silt ML (10 YR 3/2) SPT 10/ 0 Diskag gallowith 2/6 SOT 18/A /10 YZ ٥ 2/2 muist 5 -mobably fill from 9KCBY2 7 <u>نيواات له</u> Hator on aver oles Sovor wet a 9.5 Fow. soft comen silt MI 13 0 score ime concertions 154 3/11 10 X las Muchasumi MOH 11/11 com into Clamera PAI 2 0 Slightly Charge 15 70 C-100

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MW18-6 100 50 EA ENGINEERING. SCIENCE AND TED-INCLOGY, INC. LAND RASA E smule vernes HSA - Lhillow Sign 87-08 LOG OF SOIL BORING CMC150 SPLET a 2 Co-ordinates: . Spr- Smari & מוחות בנמות לא אתב - על צובה ע + 19-201+ somo(2-20/34-1.2) down SHILLING Surface Elevation: can 140 lahemmer Iras-Allin 30" START & FINISH 2.5 Casing Above Surface:__ WATER LEVEL | 4.5 17.37 17.57 17.73 Reference Sievation: 1115 1335 Reference Destination: MELK 10 32 st PM Caline TME 1 0835 0745 0800 12-4 12-5 SATE REFERENCE | SULF LEF DEF REF 11-29-17 1-20-57 SURFACE CONCITIONS: GRAFING 1 Oct 100 100 100 111714 (200-) Xcc drive black moist mois still a clay CL 3 0 3p+ 13 (54211) TOPSOIL 75 2 3 clans 1512411 CL moist 61142 CL 5 0 ST 18/0 65 wet while drilling Nater on roda@ 1.5 ينطار CL Median dark agan folice accom wet very saft sita Clan Ser 118 0 (N4 /5/4/1) 10 " last Mertakune X acountered horizor drilling totalen = 12.5-135 (WYR 5/2 Light nive arm wellowish boson 1 18 15 tainin) 0 deilling beginning Uhredon 5M

MW18-6 ea engineeping. LCAAP/ARCA E THESIBE USATISAM 454 שאנשות שנייוסטו LOG OF SOIL BORING 87-08 Smillt SPT Co-ordinates: _ SAMPLING WETHOOK 20 SMLLING " Surface Elevation: START | FINISH Casing Above Surfaces WATER LEVEL TIME Reference Elevation: TIME 1 1 Reference Destruction: SATE SATE JA FE REPERENCE SUPPACE CONCITIONS SAMPLE IN OWNER IN BITTEL GRAFIEC LOS and bown atternating hirizont 14 against yer mit 17 SOT 18/0 20 (10 yah) IFYR OLD monium VIEW 2 3 Viru loans med-235 6 WITE: ICT Olive avong mest 0 1545/2X myra alloh man properly 25 CVM BATTOM OF realt alig my retrilled is MAG 0 250' Diver- washedowt with set of med down 1012 - 104 mit 1 hotellation Jac+ 1335 Ace . 1440 sand down with mure 5-1 ichem. 2.5 30 Anvir Shows surject 7.5 - 25.0 Servin : 12.5- 22-5 الأدمر لد بهند Score - 19.5 (1) 0 + 5.0 Station 1 150 - ity bactive nasing sit a lace

MW17-5 SA ENGINEERING. SCENCE AND TED-INCLOGY, INC. SATHAMA icean/inia HSA . Hallow Stom Arese SCAING WO -LOG OF SOIL BORING 63° 1.0 : CME 753 Dith 87-09 Co-ordinates: . Tist: ~ Z 18° 12) do van 1 SMILLING Surface Elevation: Sall is 30" | START | FINISH Casing Above Surface:_ WATER LEVEL 1 16 . 51 3.954 293-1255 Reference Elevation: Reference Destrotion: Mrt as Tio & PYC Caura 11145 10800 10915 11405 108551045 TME LAYACE 2-3 12-4 12-5 12-6 * ORY SHEEM ON MARCH, 2110 100- From REFERENCE SUTT REF | REF | REF 12-3-372-3-57 SURFACE CONGITIONS 7.1.D. - Madwan Clared cdia incine to MINITED COMMIN north DK. Usllowish trown must clamou silt ML/10 78 4/2) O SPT 196 0 4 (576/1) 5mg silty class smill orange iron staining KOT 18 (Spoom 8'+down 40 12' Commie on the actor austing a 6 alive arm wet still alth clay orange 50113/8/10 0 DOWN (5122 las Michaine 100h STAINING Drilling msistance mount 25-11 layer cake static 4 1 It dive some rellarest more & lima triminal se it relan SPT 18 4 110425/16 174 W/V et medium still Relatively softer materials enagentering survey of ellipse - 7 7.3

- C-104

1720

MW17-5 ea engineering. Science and Technology. Inc. LCAAP/ERS 3 USATHAMA TUASTBB MSA ימסירושי פאיבוואכ 87-09 LOG OF SOIL BORING SHEET SPT 202 Co-ordinates: . SAMPLING WETHOO: -Surface Elevation: START | FINISH Casing Above Surface: nu (WATER LEVEL Reference Elevation: Reference Description: SAFE SATE SAFE REFERENCE SUPPACE CONCITIONS CASING SAMPLE E 1111 AF 111 C JOHN THE CLASS Illaborate upliquish brown with Stilly closers of H (10 4251A) reister & manger 1100m 2 3 Moderate 111/1 muist brown netvern stift SPT 18/8 235 6 M 10 25.0 ¥ 5 paretrison WELL INSTRUCTION auces Nu) - brothing dotinite in ok Josi two ridine cutto 30 5-4-: 1150 in 55 gal wome provided by and : 1300 Olim rokus 2. 1-2.5 2.5-7.5 Some out: 75-25.0' scrin: 12.5 - 22.5 6.0.IN (V7.0 Riser (102-5.0 Lemaths 145 5000p + 17/15 10-20 20m will A moreletim Ser MES INC cestort 140 1311

MW17-6

		LOS NO. CLENT LOCATION
	EA ENGINEERING.	THASIBO USATHAMA LEAPPLACE
	SCENCE AND TED-INCLEGY, INC.	SHILLING METHOD: HSA- Hallow Stomphon Bonne va
	log of soil boring	0+17 6=10 CME 150 All-tomin 87-10
•	· ·	dei! ria smeet
	Co-ordinates:	summing verice: SPT- Strated Brothan 1 or 2
		Tist 13" solit com (2"13 18"13) Joven 1 SMILLING 1
킨	Surface Elevation:	bu & (a) 1h. havener free & Iline 30" START START START
Cum Labal WEYERN	Casing Above Surface: 2.5	WATER LEVEL 721 32 25 26.69 25.00 TIME TIME
J.	Reference Elevation:	TIME 1015 1310 10820 11400 10810 1010
3	Reference Desnotion: Mark in Do 1-3/C Pasing	
7		2.2.
7 7		REFERENCE SURF REF REF 126F 12-4-377 2-4-47
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7 7	TANKE TO THE PROPERTY OF THE P	7
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<u> </u>	1 1 1 1 1 1 1 1	alther in most hard (CL)
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	70 - c-	106

SATE REFERENCE SURFACE CONDITIONS: HI CHICA (PPM) DEPTH OF 111111 10 0 15 (5/9/1) 18 2 2 3

ea engineeting. Science and Technology, inc.

LOG OF SOIL BORING

Co-ordinates: .

Surface Elevation:

Casing Above Surface:

Reference Elevation: Reference Desription: TME SAFE JATE L+ olive arm maist herd silter (tem/CL) grand from etalinine No water or mud encountered on rade plus, or spoon during drilling from 0 to 30. ML Vollowish orange moist have classin silt. (M) 0 Some dusky well brim iron somme 16 25 K 20 110 m22/2) (.9" to 1" pieces of checky limestone coming up in augre cuttings - angulor SPT 18/8 US 7 Mad. yellowish Drawn moist (contained soutunited) vom 0 17 clamen 51+ - MI لاع كآ Acres & 530' 15 Bottom in Hale 10 30 WELL INSTRUCTION: Dulled allook in live Offer town alem hale. enterine halo after selling 9 00 1275 5 type. 1215 7-4 ond 2.7 Sink.e 1 40 4.0' יאותותות 4.0 40 9.0 Somi ant. 90 730.0 20010 · 1.5 to 27.5 3. 1. Will: 28.0 210 10, 10.3 300000 / FISPE שימש (10.0 SCMM , 0.5 DIVA) <u>. . .</u> Ś D114 -120.5 ambien com not a 1915 Δa C-107

T45166

SAMPLING METHOD:

WATER LEVEL

MW17-6

Lisap/sasa 7 BORING VO

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~ _ SHILLING

START | FINISH

USATHOM

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ce va EA ENGINEERING. SCIENCE AND TECHNOLOGY, INC. LCARD / PRIA C BORING VO ING WETHER HEA - WILLOW TEN AREIR LOG OF SOIL BORING 12 64" 1.7 : CME 750 ALL 87-11 RIG TisiLapin Della Co-ordinates: SAMPLING WETHOOK SPT. Strandord Port Tol 102 MININE CUMIN LAYNE-WE SPERN 1810) (Z).D. SMILING Surface Elevation: fre-faline 30" | START | PINISH Casing Above Surface: _ WATER LEVEL 1070 15.66 15501 Reference Elevation: Reference Desnotion: Mark in Top of PYC (Sim TME 0710 1155 0150 1830 1605 1945 SATE 2-5 25 12-6 17-7 MERERENCE | SIZE | REF | REF | REF 124-37 2-5-37 TOM BALES SURFACE CONCITIONS: P.I.D. GHAFING 1111111 10st-6 لدا ور west and nowh isky violouish town most at it classift 0 Year SPT 19/ 0 brown maist st d 511+ 0 5 6 Lt olive arms and rellowish orance moist vars 0 1/10 YOL 5/6 8/10 511+ <u> ciènen</u> ML " Idw Machae as Home casife a 12-13' and don alter Lycerine to 15 7 como wet maid 141 I'K. ULILONIS' Tran Wer medium . time send 4- Dilt SET 19 - midium deme Jand rining after drilling -0 20 - 1504 miler pit to close not - '70 and 400 בוחת מאייהא 10

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	EA ENGINEERING.	. OB VO. CLENT .	LOCATION
	SCIENCE AND	TIMESIBO UKOTLAMA	LEADP / Origa c
	TECHNOLOGY, INC.	SALLING WETHOO! ILSA - HILM SEA	Aur Sching vo.
	LOG OF SOIL BORING	940.2 62-12 CHE 750 1	
	- FOG OF 301E 30111114		Smilet
		Loren deilleia	
. : 1	Co-ordinates:	SAMPLING WE'NOO! SPT - Simile ! Sam	
3	Cudan Cuning	Test 13 201 + same (7° 1.0, 15°10)	
WESTERN	Surface Elevation:	2 140 16 hammer from Lalling 30".	START RINISH
17,	Bafaranca Blaustick:	WATER LEVEL 1/6 2 1/6.82 1/0.01	TIME TIME
थ।	Reference Destrotion: Mark antip of DVC Cising	TIME 10735 1712 1730	1640 0500
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U		REFERENCE SURF 250 REF	125-87 2-6-37
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EA ENGINEERING.	CLENT LOCATION
SCIENCE AND TEO-NOLOGY, INC.	THE SIDS USATHAMA LORGE ANGLE
	SPILLING WETWOO: HSA BORNE NO. 87-12
LOG OF SOIL BORING	SNEET
Co-ordinates:	SAMPLING METHOD: SAT Z 02
	DAILUNG DAILUNG
Surface Elevation:	START FINISH
Casing Above Surface:	WATER LEVEL 16 92 TIME TIME
Reference Desription:	TIME 17/0
	DATE DATE DATE
	REFERENCE
E 12 / 30 13 / 3E 000 9 3CAPAC	CE CONCITIONS:
SAMPLE EN LAND CASING C	
1 /1 / 1 / 1 / 1 / 1 / 1 / 2	wish journ wet soft clower gilt (CL)
1 2 1 1 2 11	DYRAE
SOT 18/8 20 521 3 0 1 X ML 209.	
	wish bown wit 3,14, some fine and (MI)
	No syn-up - Inaded nyters with
	مدوا و کامور مام الملا کمان کار
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5 18/ 2 5 0 6 5M CIO	Ve 4/4) - medium denne
SOT 18 25 10 5 0 8 5M (10	
	13 (1) (1)
10/10/19 0 Tales Park	- nollowish from wat m-found tree soft (5m)
411/19/00.7 1/2.51/2	ve als \ - mea remal
	years to x'
3.	- 46 0 30.0°
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	The state of the s
	54,- 1915 7-3-37
3-	Eng: 1110 , "
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	200000 : 3.54 85 Has 5 maps
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	Secreta : 17.3 to 27.3
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	list U.O (2x19.0')
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	at post CKE of 1110
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		LICE VG. CLENT
	EA ENGINEEPING.	
	SCIENCE AND	TURSIBY USATHAMA LCARP/122C
	TECHNOLOGY, INC	SALLING WETHOO: HSA - HOLLOW Sten Frace. SCAING WO.
	LOG OF SOIL BORING	9+'02 62'10 : CME750 411- 87-13
		torrain drill ris SHEET
		TOPPOIA GPITE
, ,	Co-ordinates:	SIMPLING VERNOON SAT - Standary Brotheria / a Z
$\langle $,	Tost: 18" solit sense /2"10 184" 10.) rover & smilling
2	Surface Elevation:	a 16) 16 haman free filling 30" START START START START
	Casing Above Surface: 2.5	
2	Reference Elevation:	173.3 1/8.8 6 171.9 1 17.80
DINITURE CHAIN CONNECTOR WESTERN	Reference Desnation: Mark on Top of DIC Game	TIME 10810 1045 1140 10905 1515 1705
7		34TE 2-7-871 2-7 2-9 24TE 24TE
W .		MERENCE SURF REF REF 2.6-57 26-87
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3 2	PLD.	
₹,2	THE PARTY OF THE P	
<u> </u>	SAMPLE CASHING	sirm for tak!
J 3		the ball and the state of the s
3 12		mesh black moist softchangs HML)-tossoil
=		(5y E/I)
3 1	ST 18 0 1 2 0 1 Mad	
	10 /1 V X /5	23/6 - SOCH FILL ML
	SPT 10 3.5 25 4 0 4 5M 100	with brown moist mod-Line sand crace silt
		18 16 - loose SM
	5 V ₅ M	<u> </u>
		wish brown must m Some med dense (SW)
	3 0 1 SW (104	26/4) File likely
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IN Nachman		
_ \$!		
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V		
77	SPT 18/9/35 4 3 0 4 SM Dar	e it il barrier Lace time and little
23	SPT 118 13.5 4 3 0 4 - 5 M Dark	m 8/2) 5/14 (SM)
		40 an rada @ 157'
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		minish trans 100 oce - beauti some - 15m)
		(2, 2/2,)
		ing arm (545/2) wet east silting from (C')
		THE PROPERTY OF STREET
	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	in himman (AV 2112) with the it stime sive stone (M2

MW16-1 LCAAP SCANG NO. 86-01 1 = 2 241_16 I,14 in 304 5-187 1900 10401 trace Link sand

ea enginee=ing. Science and Technology, inc. USATH AMA STOR AUGER LOG OF SOIL BORING HSA SAMPLING METHOD: STANDARD PRINETTRATION Co-ordinates: _ TESTE (SPT) - 18" Driver solit Surface Elevation: 5000 - 2" 0.0. -16016 harmer Casing Above Surface:_ MATER LEVEL | 22.301 20.491 Reference Elevation: Reference Desription: Maria 47 0805112001 Luna Th **30** "Kyck. CATE 5-7-96 5-2-66 REFERENCE REF RES! 5636 5536 \$6 \$5 4CE CONC! TONS. PI.D PM TO LINE GHAFING FIRESCICI) HILLY RO whist men in still situation - CL 0 SPT 1.5.0 ے uolinnish briwn 10 x2 c/c/652 0 7.0° 4 DIFFICULT AUGUSTING -INTO WEATHER ED SIALIE ML Moint have clarsilt true Lines and (Westford stile - his ingrato Anion stim LIGHT Olive Down -SOT 1.3/4 9.3 3/32/05/52/0 Most hard clause sult ML 10 (ypothoron Inde المعرور - رمرم مر -ich + alive us warm arons 16.0-16.3- easier eucering ML SPT 1/4 143 4 30 0 Moist hard claym Sulf trave the small (wathered state - harismant) جهز شهرار مهدى ian olive wollow arous CC Most hard is in Flow - moveralch weithout shale Merina arou - NE' 19.3 5 C-113

MW16-1 .CE VO. EA ENGINEETING. SCIENCE AND TECHNOLOGY, INC. USATHAMA CAAD שאונוואק אנדייכם: 86-01 LOG OF SOIL BORING Seil Co-ordinates: _ SAMPLING VETHCO: 2 = 2 SHILLING Surface Elevation: START I FINSH Casing Above Surface:_ WATER LEVEL Reference Elevation: TIME Reference Desription: _ į 2271 CATE 37.5 PEFERENCE 14.25.55 CONO. 75.4. P.I.D. 20 t Moist more is the name (wenthered shall w) CL SPT 0.5/2 243 6/50/4 0 ו מגיבורש לבלובי לבה Mod Lark aran -HAM Renovine @ 1515 50 03 29.0 7 290=0/2 HOUD by Linn VI wending 1600 0 of line stone armed 1:45 dilto clan is chesonid - Bod roch Light olive gran 54 U/2 BUH @ 29/1) BOSEMELING- #9.2 WELL INSTALLATION -500m 1615 Isa pip. SCROOM 17.0 Aliren 200 306 total 5th chup 3140 through recers pad - Oulis 2. Ellip wister ones selecte-let sixt for 5 min unker + Set Sunt Inch.

25 hrs - W arrest Srittement

	· · · · · · · · · · · · · · · · · · ·	MW16-2
	EA ENGINEEFING. SCIENCE AND	THA STBZ USATHAMA LCARP
	TED-NCLCGY, INC.	SALLING WETHOD: HSA- 12" 0.0,65"1.0 SCAING NO.
	LOG OF SOIL BORING	CNX 55 RIG 86-02
		Seist
ا إد	Co-ordinates:	- SAMPLING WETWOOD: STRANG. DAN. TIST(SPT) CO 2
7	Surface Elevation:	18 drien solit som 2° a.D. drien som
Ą	Casing Above Surface: 2.0'	MATER LEVEL 19,494
\$ 5. X	Reference Destriction: Mark IA PVC Cim	TIME 1/2/10 945 /430
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ية كإ	*sramic oder	- 1475 14 1 5-7-16 5-7-16
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Melak.		
		Anst puphism sill clarge set; trace + and
3 1	SPT 1.5 0 0 5 1 NL	phio arm: 5/3/2 (GSF) MI
,		
	ST 50 45 2 0 3 ML	Moint solt clause silt trave fine sand ML
		Olive aray -51'4/2
	 3 ¥ •	
		Slightly hardor augoring @7.2'
		Huan rada @ 8.2
	5011 75 9.5 3 0 10 ML	Net medium stall a layer silt trace Line some
U. 2	1 1 3 4 8	Light plin gray - 545/2 ML
X		
•		
-	15/16 4 2 50= 1 ML	Not so It clausy self, trace M-I sand ML
74	ST 1.5 14.5 45 2 400 15 ML	- Clarte ofly strem on outside of 2'=1"
7 7	3 4 8	of solit soon
		Breathing area OK - windy day
		Etales & Love D.
. •		BXT FGE
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EA ENGINEERING.		7457BZ	clent USATHAMI	1	A TION	
SCIENCE AND			ואיביה ו דובט	7 1	CAA	
		SRICENS METOR			1	-02
LOG OF SOIL BORING		<u> </u>			1 2545	
Co-ordinates:						× 2
		SAMPLING VETHOS:			3AU	
Surface Elevation:				· · · · · · · · · · · · · · · · · · ·		FWSH
Casing Above Surface:		WATER LEVEL			308	
Reference Description:		Time				
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5/30 -						
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371 105 124-5: 125t			cture promine			
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		had some				
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	H -	cirima 4	awas c.s.	2032		
	- c-1	.16	·			

MW7-10 ea engineering. Science, and Ted-NCLCGY, INC. USATHAMA THA 5789 LEAGE /ARSA C BORING YO -HSA LOG OF SOIL BORING 87-14 Co-ordinates: _ SAMPLING WETHOD: 577 て って SHLUNG Surface Elevation: _ START | FINISH Casing Above Surface: _ WATER LEVEL Reference Elevation: _ Reference Destination: _ CAPE SATE SATE REFERENCE SURFACE CONCITIONS: Hariman in Significant 20 Derk collowish brown wet sat sit of clay som 20 5/21 0 (10 VE Ch) ML 2 Modern emaish / bluish arm not soft clause si/4 MC [ML [(5G/55/1) 0 3 25 Yollowish from not Line send. Sime SIT (sm) (10 x 2 3/2) - looke Yollowish from wet mad donne madium to time sond SM Ser 18 28.5 7 0 951 (10 42 4/4) 24/a) 1,46 1/1+ August -530' 12 1500 <u>⊬</u>30 🛚 Bother of Hole @ 30.0' WELL INSTRULATION: 2-3 - 3' Sand run 10 m mucho - respect dot with 30 and His last given ha - initally will though each moulen Sint: 0945 2-9-27 usal mither 70 m 1 - 4-97 to this cam water End: 1115 in hale. Story: 2.3 Sout: 0 to 2.5 8, 964 77 1 /2×17 17: Particle: 65 to 7.5 SC002- 105

Sandade: 15 - 30.0

C-119

Somen: 17.2 + 67.2 13.1.MO 11: 21.1

St scientivo resine a 1115

JWS

30.5°

	ea engin	EERING.			-06 NG	CLENT	,	ation CAAP/	4000
	SCENCE TEO-NO	. AND LEGY. INC	_		7:45738	USATHAM B HSA-1516			
LOGOFS	OIL BORIN					3.13 : CME		87-	15
					tornia de	ill nie		SHEET	
Co-ordinates						SPT- Stamp			- 2
Surface Elevi	rion:					11- 2000/20019		START	
Casing Above	Surface:	2.5			WATER LEVEL		70	nw€	Time
Reference Si Reference Di	eription:	re on Top	مع کو در	ing	TIME	092111465		4	151
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SPT 18/	3/	2 0	I I	110	YRG/2)	[144)		, ,	ML
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	EA ENGINEERING. SCIENCE AND	THA 5761	USETHAMA	Liene /AREA B
	TEO-INCLOGY, INC.	שוניות שבדיססי	HSA	SORING NO.
	LOG OF SOIL BORING			87-15
				SMEET
	Co-ordinates:	- SAMPLING VIETHOOD	SOT	7202
1		-		2MLUM6
- 1	Surface Elevation:	-		START FINISH
	Casing Above Surface:	WATER LEVEL	1 1	TIME TIME
•	Reference Desription:	TIME	1 1	
- 1		STAC		CAFE SAFE
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भागा १६६५ टच्या ।	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	te mallowish ho	war wet soft a	11/1+vlan some
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			(MC)	
		 		
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	SCIENCE AND TECHNOLOGY, INC.	THASIBO USATHEMA LEAD PLEAR
	LOG OF SOIL BORING	70.0. 62"10 ME 750 A11 - 87-16
	Co-ordinates:	SAMPUNG VETHOR SPT- Standard For 1 & 2
3	Co-Granitas.	70 St: 18" 47/14 Sans (2"4) 14 (3) from OHLUNG
POPEL CENTE LA VALE - W. C. STERAL	Surface Elevation:	by a 10 16 hammer Gree falling 23" START START
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EA ENGINEERING.	7745168	USATHEMA	LCAP/A	ece a
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LOG OF SOIL BORING	Surffled Attack	rar:	87-1	_
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Co-ordinates:	- SAMPLING WETHOD	سر قری :	2 0	Z
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	Start 1445	2-9-37		
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	F-RAVI O-	4.0	BMA - 10.5	
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1W12-2 **USATHAMA** SOMING NO ORILLING METHOD LOG OF SOIL BORING Co-ordinates: _ SAMPLING METHOD: Surface Elevation: START FINISH Casing Above Surface: WATER LEVEL Reference Elevation: TIME Reference Desription: _ DATE SAFE REFERENCE SURFACE CONDITIONS: GRAPHIC 257R 6/4 20 to odens 2 3 our slide si 5 13 25 10 feet 1) was writer - 55 rods 7 man said women lor simo ケノレナー = 1/E =13 1420 ed. 1540 ٦

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USATHAMA we wereco HSA Then L'4 /D LOG OF SOIL BORING Co-ordinates: Surface Elevation: . START FINISH Casing Above Surface: Reference Elevation: 35+11:55 10:05 Reference Desription: TME SAPE 2/11/27 REFERENCE SAMPLER CAMPLER 2450 CHAPINC 100 6 mes 1 44 0 nun 0 14 s.do. de. 2,5 YR 6/4 SM Ξ 7. a liter 0 1

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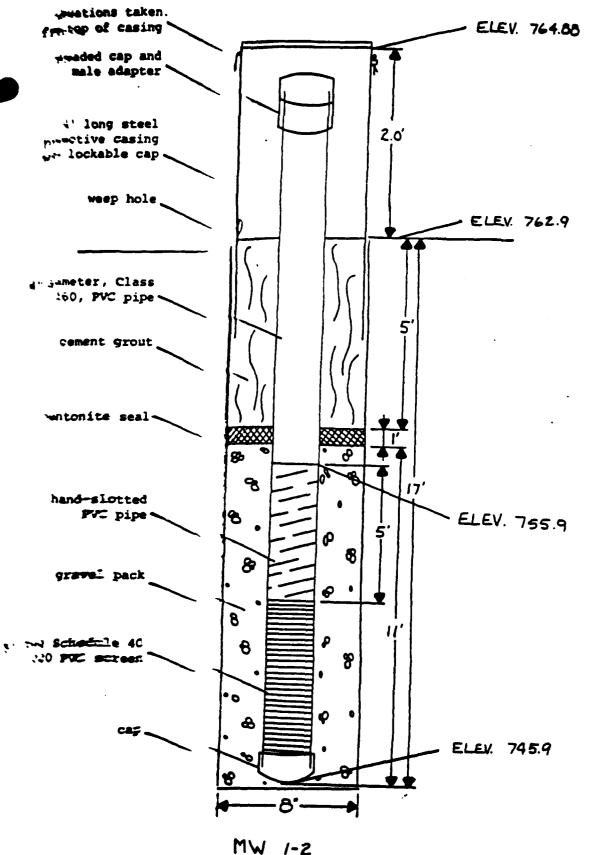
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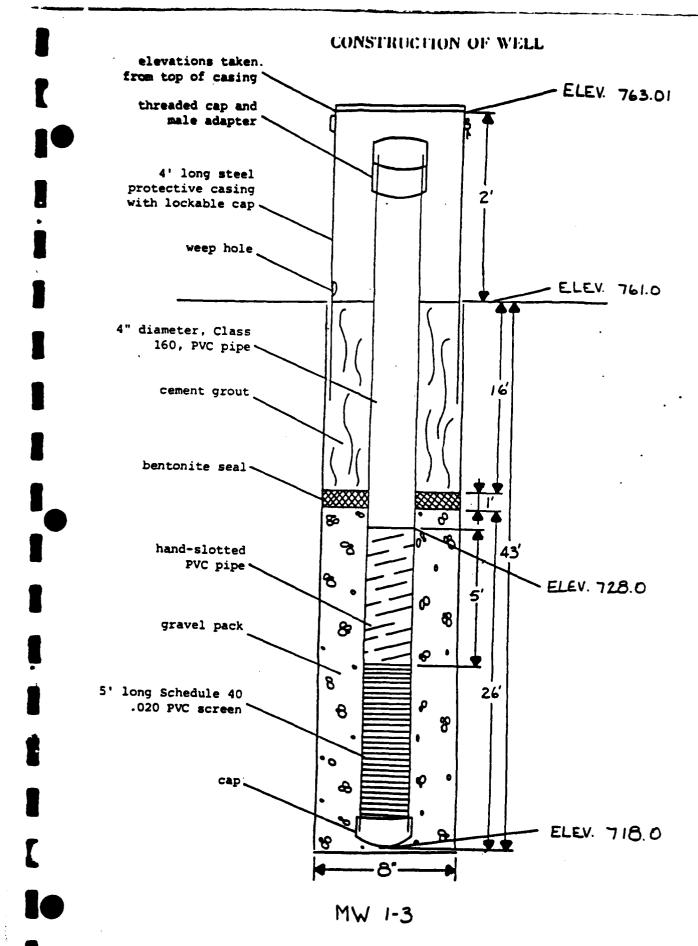
CONSTRUCTION OF WELL elevations taken. from top of casing ' - ELEV. 777.22 threaded cap and male adapter > 4' long steel protective casing 2.3 with lockable cap. weep hole ELEV. 774.9 4" diameter, Class 160, PVC pipe > cement grout 10' bentonite seal -8 20' 8 P ELEV. 759.9 8 gravel pack 8 8 5' long Schedule 40 .020 PVC screen θ • 0 cap 8 ELEV. 754.9 MW 1-1

	Lake C					Boring No. <u>HW 1-1</u> Sheet <u>1</u> of
drass S y & State	Inde		·	ssouri		Date Started
,	- +			Abt	ordiviations:	A.O. — Auger Only R.B. — Rock Bif C.W. — Core Went H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bi
DE	PTH]	PENETRA	TION RECORD	≥	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO. METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
0.0'	10.0'	WB				Weathered sandy shale
10.0'	13.5'	WB				Same
13.5'	19.5'	WB				Gray & dark gray shale, med. to stif
19.5'	23.0'	WB				Same
23.0'	30.0'	WB				Maroon shale, stiff
20.01	40.0'	WB				Light gray shale, stiff to hard
40.0'	Total	deptb.				
			_			
	asing, Water					STETIC Water Level Time Date
штреа	1-1/2 h	our -	1/2 G	PN	-	1.7 9/11/81(Completion
•	estern					

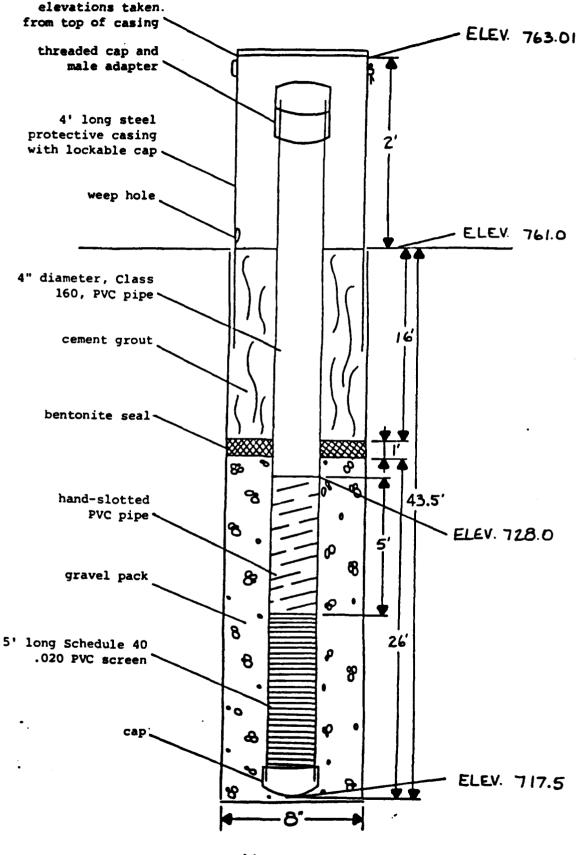
JAINSTRUCTION OF WELL



et L	ake Cit	y AAP		<u>.</u>		Boring No. <u>MW 1-2</u> Sheet <u>1</u> of <u>1</u>
						Surface Elevation 762.9 Offset
955						Date Started 7/29/81 Completed 7/29/81
State_	In	depend	ence,	Missouri		Driller T. Butler Rig
				Ab	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit S.S. — Split Socon S.T. — Shelby Tube C.W. — Core Water C.A. — Core Air F.B. — Finger Bit
DE	РТН			ATION RECORD	<u>}</u>	SAMPLE DESCRIPTION
ROM	то	METHOD	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
.0'	5.5'	WB				Dark gray silty clay, med. to stiff
.5'	10.0'	WB				Dark gray silty clay, med.
0.01	11.5'	SS1				Dark gray silty clay, med. to stiff
1.5'	17.0'	WB				Weathered sandy shale, med.
7.0'	19.0'	WB				Maroon shale, stiff to very stiff
9.0'	22.51	WB				Light tan & light gray shale, stiff to very stiff
2.5'	26.0'	WB				Light gray shale, med. to stiff
3.01	29.5'	MB				Same
9.5'	35.0'	WB				Same
,,	37.5'	WB				Same
5'	40.01	WB				Maroon & light gray shale, med. to sti
0,	Total	depth				•
				· · · · · · · · · · · · · · · · · · ·		
						•
RKS: (Casing, Wate	r Loss, Etc)			Static Water Level Time Date
umped	1-1/2	hour -	1 GP	M .		1.6 9/11/8(Completion)

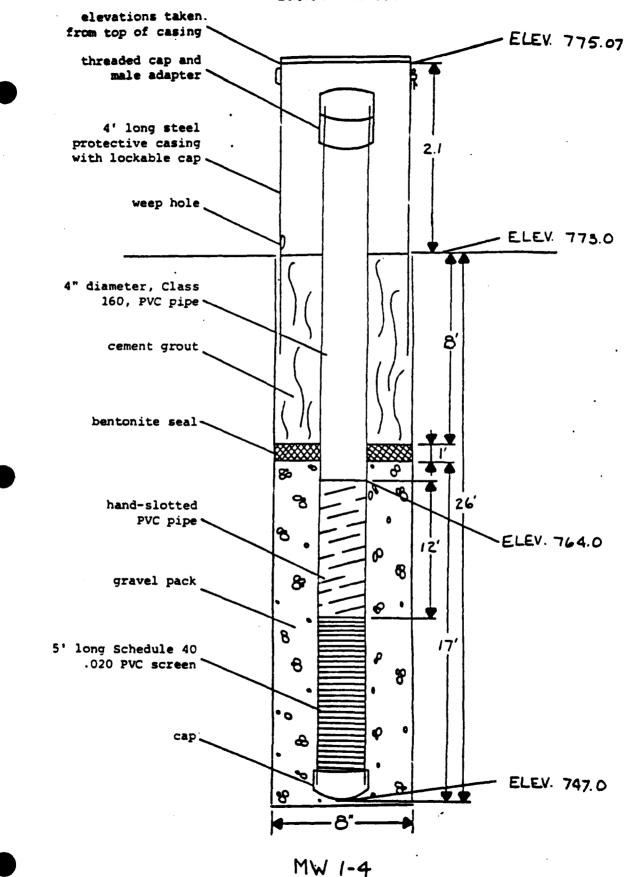


CONSTRUCTION OF WELL



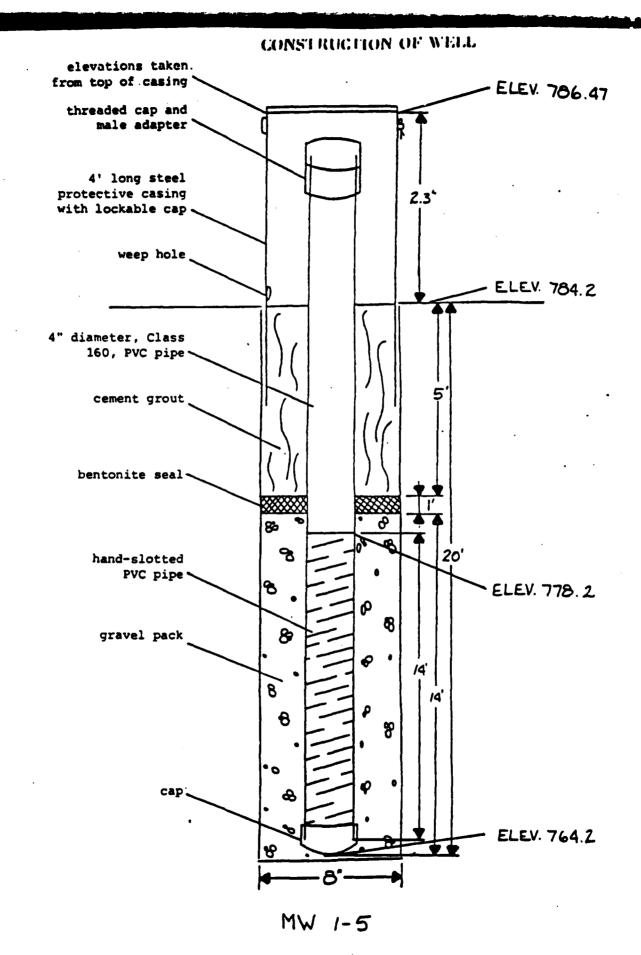
MW 1-3 Sheet 1 of 1
761.0 Offset
/30/81 Completed 7/30/81
Butler Rig
ly .R.B. — Rock Bit C.W. — Core Water uger S.S. — Split Spoon C.A. — Core Air E. S.T. — Shelby Tube F.B. — Finger Bit
SAMPLE DESCRIPTION
MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
silty clay, stiff
ty clay, soft to med.
ty clay w/trace sand, soft
ty clay w/trace sand, soft
ray silty clay, soft to med.
clay, med.
clay, soft to med.
trace clay
, hard
LC evel Time Date
9/14/81 (Completion)

CONSTRUCTION OF WELL



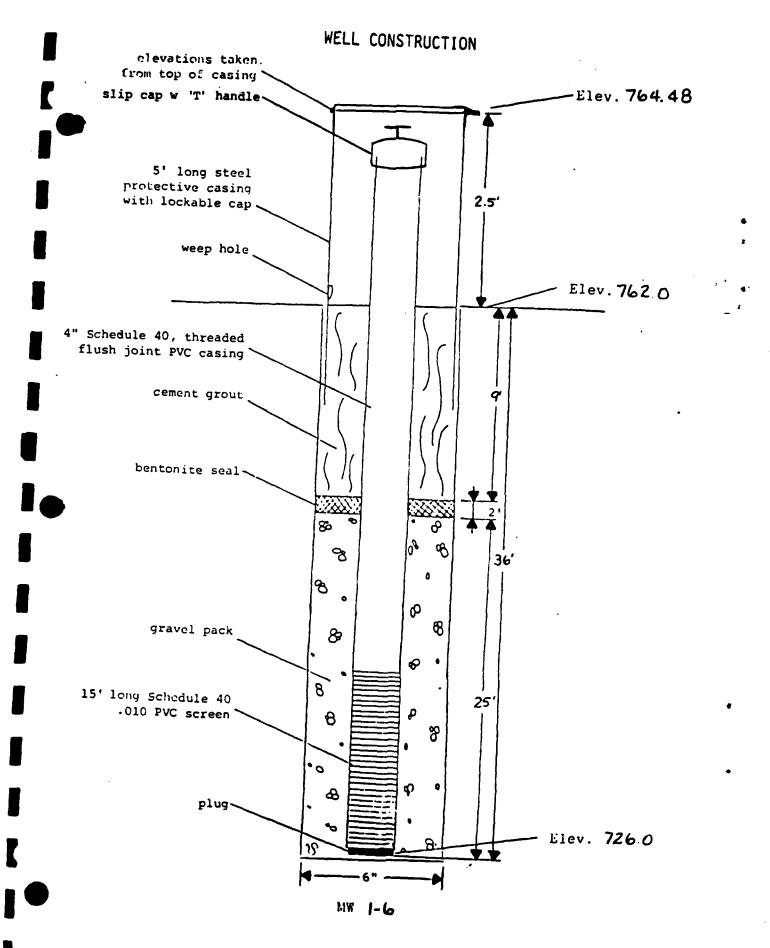
oject	ake City	AAP				Boring No. <u>NW 1-4</u> Sheet <u>1</u> of <u>1</u>
	·				·	Surface Elevation 773.0 Offset
louess				·		Date Started 7/31/81 Completed 7/31/81
y & State_	Indepe	endenc	e, Mi	ssouri		Driller Rig
					Abbreviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit C.W. — Core Weter C.A. — Core Air F.B. — Finger Bit
DE	РТН		PENETR	ATION RECOR	<u>₹</u>	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	2.5'	WB				Light brown silty clay, med. to stiff
2.5'	4.5'	WB		-		Light brown silty clay w/trace weather shale, med. to stiff
4.5'	9.5'	WB				Weathered shale & Light brown clay, med. to stiff
9.5'	10.0'	SS1				Gray shaly clay, med. to stiff-
10.0'	10.5'	SS1		21-50/0).3	Light gray shale, med. to hard
10.5'	12.5'	WB		:		Light gray shale, med. to hard
12.5'	17.0'	₩B				Light gray shale, soft to med.
17.0'	20.5'	WB				Light & dark gray shale, soft to med.
20.5'	24.0'	WB				Maroon shale, med. to stiff
24.0'	26.0'	WB				Maroon & gray shale, med. to stiff
26.0'	27.5'	WB				Gray shale, hard
27.5'	34.0'	WB				Same
34.0'	40.0'	WB				Gray shale, med. to hard
40.0'	Total	depth				
MARKS: (Casing, Water	Loss, Etc	<u>_</u>		<u></u>	Static Water Level Time Date
.umped 1-1/2 hour - 1/2 GPM						4.2 9/14/81 _(Completion)

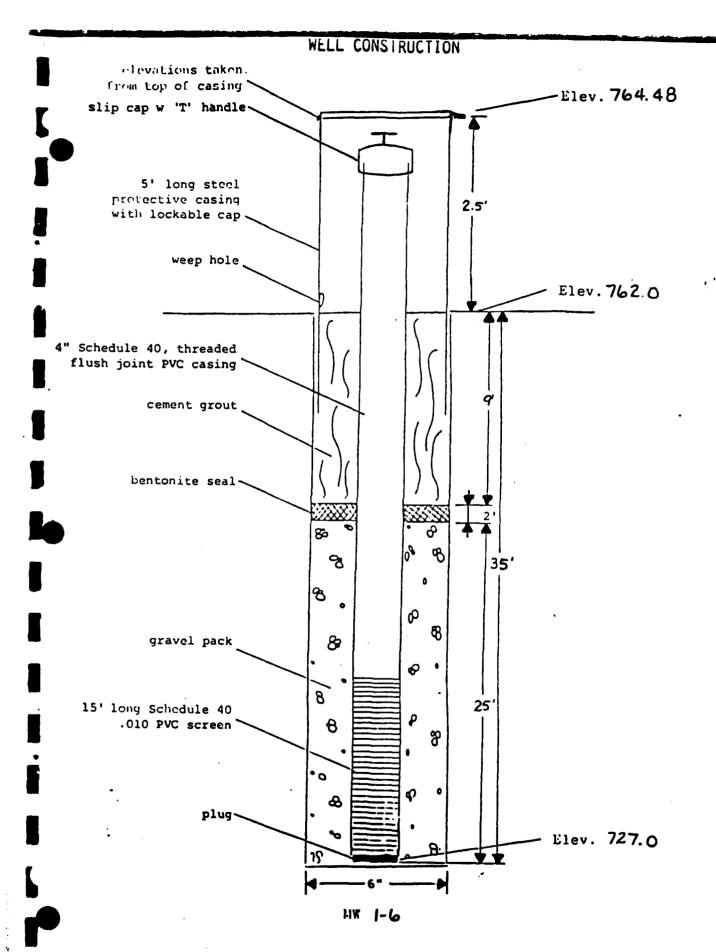
eyne-Western Company,Inc.



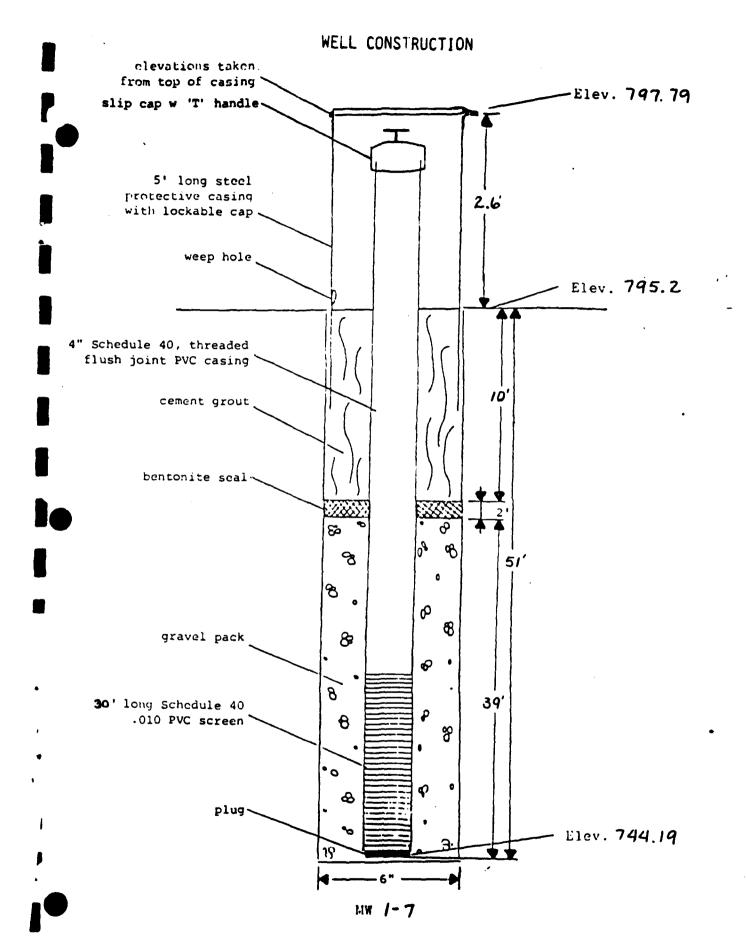
ject	Lake	City	AAP		Boring No. MW 1-3	_ Sheet 1 of 1	
						Surface Elevation 784. B	t
						Date Started 9/4/81 Sampleted	9/8/81
& State_	Inde	penden	ce, Mi	ssouri		Driller Rig	
				Abt	previations:	H.A Hollow Auger S.S Mack Bit W.B Wesh Bore S.T See Spoon State Tubs	F.B Finger Bit
DE	PTH		<u> </u>	TION RECORD	ERY	SAMPLE TESCRIPTION)N
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MINSTURE-CL	AY CONSISTENCY ND DENSITY
0.0'	4.5'	WB				Brown silty clay, soft to	med.
4.5'	7.0'	WB				Dark gray silty c; ay w/t: soft to med.	
7.0'	7.5'	WB				Light tan shaly clay, so	ft to med.
7.5'	14.0'	WB				Light tan sandy shale, me	ed. hard
14.0'	26.5'	WB				Light gray shale, med. to	hard
26.5'	36.51	WB				Maroon shale, med. to ha	rd
5'	40.0'	WB				Light gray shale, hard	
0.0'	Total	depth					
						1	
-							
							
							
<u> </u>							····
•							
						Static	
	Casing, Water 2 hours					Water Level Tilme 1.5 ' g	Date /11/81 (Completi
							(Completii

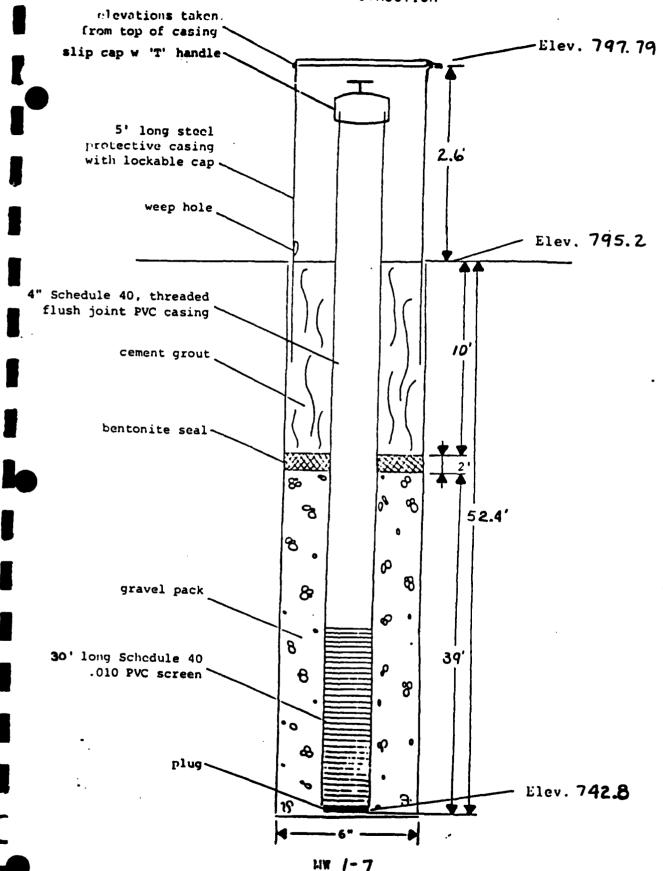
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						Surface Elevation 762.0 Offset
					Date Started 12/7/82 Completed 12/7/82	
y & State_	Indepe	ndence	, Miss	ouri		Driller B. Blank Rig AD-2
					bbreviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit C.W. — Core Wet C.A. — Core Air S.T. — Shelby Tube F.B. — Finger Bo
DE	РТН			RATION RECOR	2 ≿	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	на				Topsoil
1.0'	2.5'	на				Dark brown silty clay, moist, med.
2.5'	4.5'	НА				Brown silty clay, moist, med.
4.5'	6.0'	ST1	0.75		1.2'	Brown & gray silty clay, moist, med.
6.0'	10.0'	на				Same
۰۰۰۱	14.5'	НА				Same
14.5'	16.0'	ST2	1.25		1.5'	Brown & gray silty clay, moist, stiff
16.0'	18.3'	на				Same
18.3'	24.5'	НА				Dark gray silty clay, moist, med.
24.5'	26.0'	ST3	1.0		1.5'	Same
26.0'	30.01	НА				Same
30.0'	30.5	на				Light green shale, dry, med. to hard
30.5'	34.5'	на				Same
34.5'	36.0'	ssl		20-50/0.4	0.9'	Same
6.0'	Total o	epth				
ARKS: (Casing, Wate	r Loss, Et	tc.)	<u> </u>		Water Level Time Date

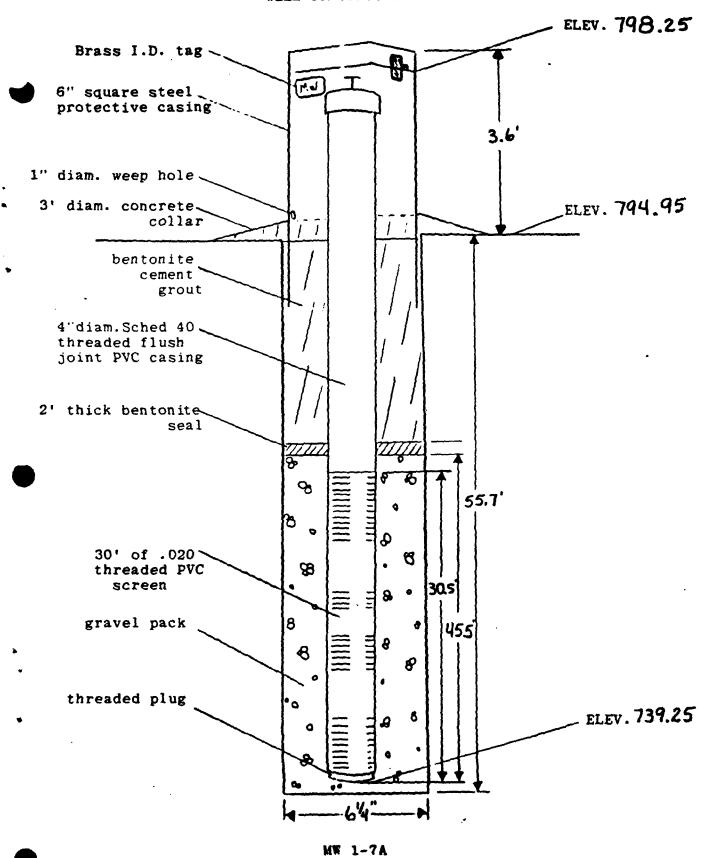




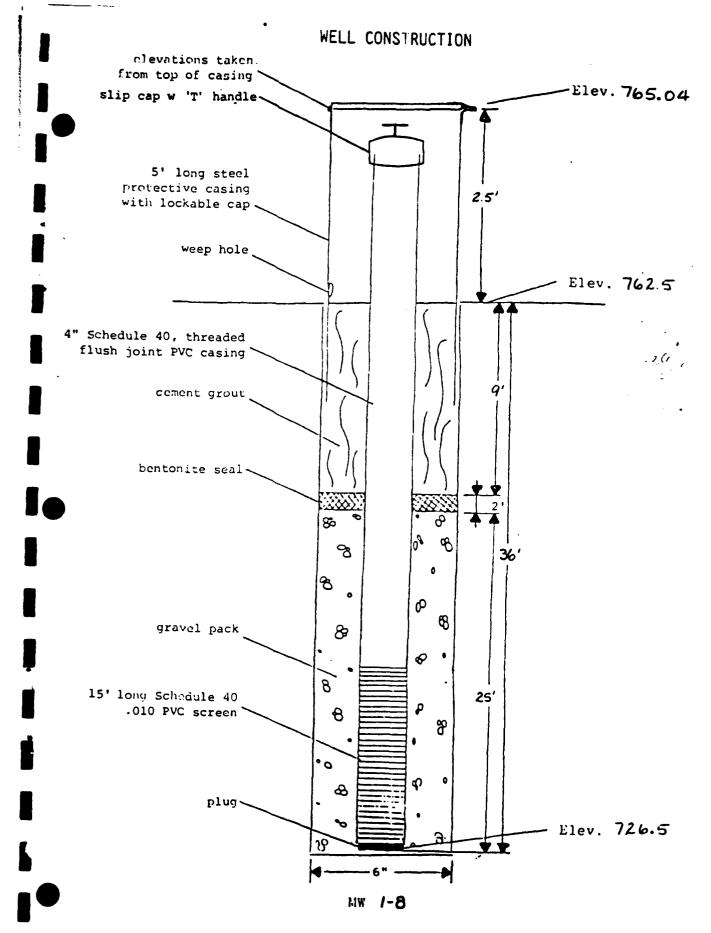
oject	Lake City	Army	Ammunit	tion Plant		Boring No. 1-7 Sheet 1 of 1
			<u></u>	<u> </u>		Surface Elevation Approx. 795.0 Offset
						Date Started 12/8/82 Completed 12/8/82
ty & State_	Independ	lence,	Missou	ıri		Driller B. Blank Rig AD-2
				Abi	A.O Auger Only H.A Hollow Auger W.B Wesh Bore R.B Rock Bit C.W Core Wa C.A Core Air S.T Shelby Tube F.B Finger B	
DE	PTH			ATION RECORD	سمًا ا	SAMPLE DESCRIPTION
FROM	то	МЕТНОО	POCKET PENETRO- METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	0.6'	на				Topsoil
0.6'	1.5'	на				Dark brown silty clay w/gravel (fill), mois very stiff
1.5'	9.5'	на				Brown silty clay, moist, very stiff
9.5'	11.0'	STl	4.0		1.5'	Brown & gray silty clay, moist, very stiff
11.0'	18.0'	на				Same
3.0'	19.5'	на				Light brown & gray weathered shale, dry, ha
15.5'	20.1'	ST2	4.5+		0.6'	Same
20.1'	25.0'	на				Brown & gray weathered shale, dry, med. to
25.0'	29.5'	HA				Same
29.5'	30.2'	SS1		20-50/0.2	0.7'	Brown & gray shale, dry, med. to hard
30.2'	32.0'	на				Same
32.0'	41.5'	на				Same
41.5'	47.0'	на				Maroon shale, dry, med. to hard
47.0'	54.5'	на				Gray shale, dry, med. to hard
54.5'	Refusal					
ARKS: (Casing, Water	Loss, E	tc.)			Water Level Time Date
	·-=: <u>-</u>					Dry 11:45am 12/8/82 (Complet

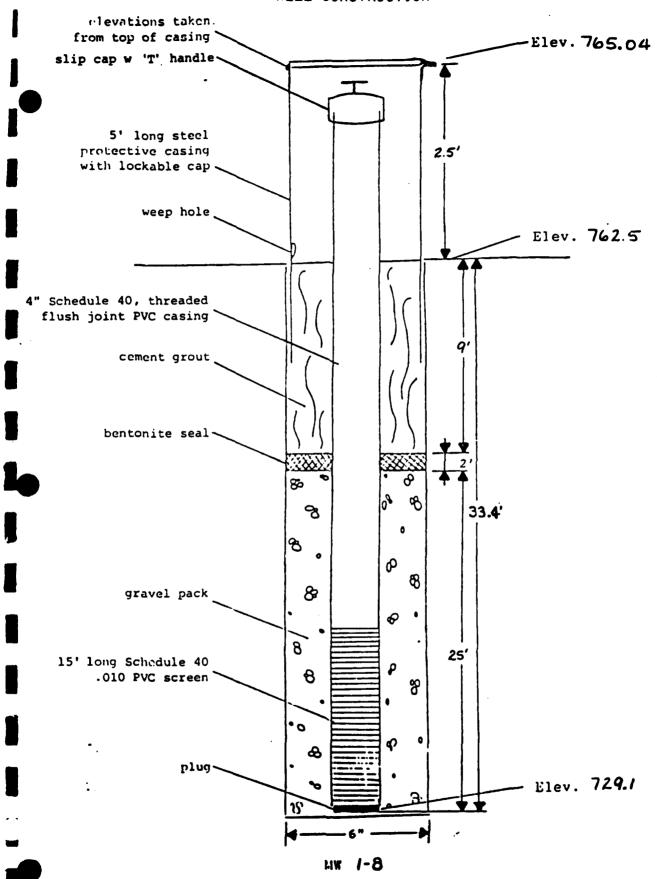
TEST BORING LOG

roject	Lake Cit	y Army	Ammuni	tion Plan			Sheet 1 of 1	
					Surface Elevation 795.2 Offset 10 'S. of 1-7			
oress					Date Started 12/13/8	Compl	eted <u>12/14/82</u>	
ity & State_	Indepe	ndence	, Misso	uri		Driller B. Blank	'	Rig AD-2
				A	Abbreviations:	H.A Hollow Auger S.	.B. — Rock Bi S. — Split Sp T. — Shelby	oon C.A Core Air
DE	тн			ATION RECOR	PY O	SAN	IPLE DESCRI	PTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIA	AL-MOISTURE	CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	на				Topsoil		•
1.0'	2.5'	на				Dark brown silty	clay, moi	st, stiff
2.5'	18.5'	на				Brown silty clay,	moist, v	ery stiff
18.5'	29.5'	на				Light brown weath	ered shal	e, moist, med. to ha
29.5'	36.0'	на				Maroon shale, moi		
هد.٥٠	51.0'	НА				Gray shale, moist	, med. to	hard
51.0'	Total	epth						
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						·		<u> </u>
						<u> </u>		
EMARKS: (Casing, Water	r Loss, Et	c.)		-	Water Level	Time	Date
			· · · · · · · · · · · · · · · · · · ·			Dry	9:30am	12/14/82 (Completion)



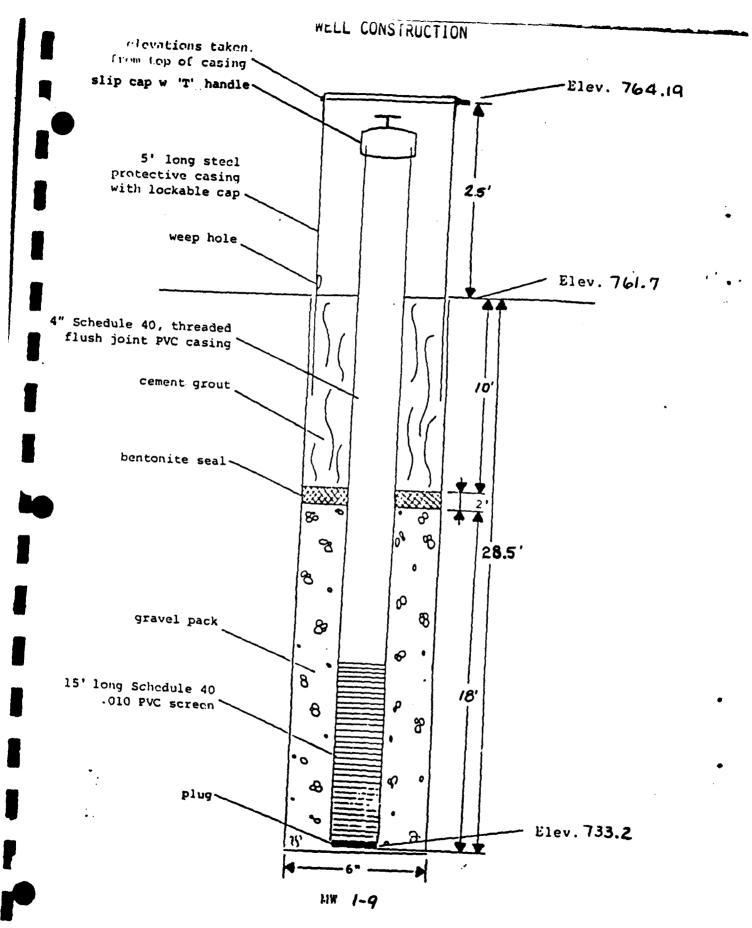
t La)	ke City A	env Am	nunition	·	<u> </u>	Boring No 1-7A Sheet 1 of 1				
	placement					Surface Elevation Offset				
										
				-		Date Started 6/25/85 Completed 7/02/85				
y & State_	Independ	ence, h	dissouri			Driller Buck Blank Rig AD-2				
				Abb	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit*					
DE	PTH		PENETRA	TION RECORD	RY	SAMPLE DESCRIPTION				
FROM	то	МЕТНОО	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY				
0.0	0.6	на		· · · · · · · · · · · · · · · · · · ·		Topsoil				
0.6	2.5	на				Dark brown silty clay, moist, stiff				
2.5	4.0	на				Brown silty clay, moist, stiff				
4.0	11.5	на				Light brown clayey silt, moist, stiff				
11.5	17.3	на				Light brown clayey silt, with trace sand moist, very stiff				
3	22.5	на				Olive-brown shale, dry, medium to hard				
6 5	24.3	на				Same, with thin sandstone seams				
24.3	24.7	на				Gray shale with thin limestone seams, hard				
24.7	32.0	на				Olive-brown shale, dry, medium to hard				
32.0	37.1	на				Dark gray shale, dry, medium to hard				
37.1	47.1	на			 	Marroon shale, dry, medium to hard				
47.1	47.4	на				Dark gray limestone				
47.4	57.0	HA				Gray shale, dry, medium to hard				
57.0	Total I	Depth								
		<u> </u>								
Marks: (Casing, Wate	r Loss, Er	lc.)			Water Level Time Date				
Water 1	evel meas	sured f	rom top	of casing		19.7' 3:30 pm 7/2/85 (Completion				
						15.8' 4:45 pm 7/3/85				

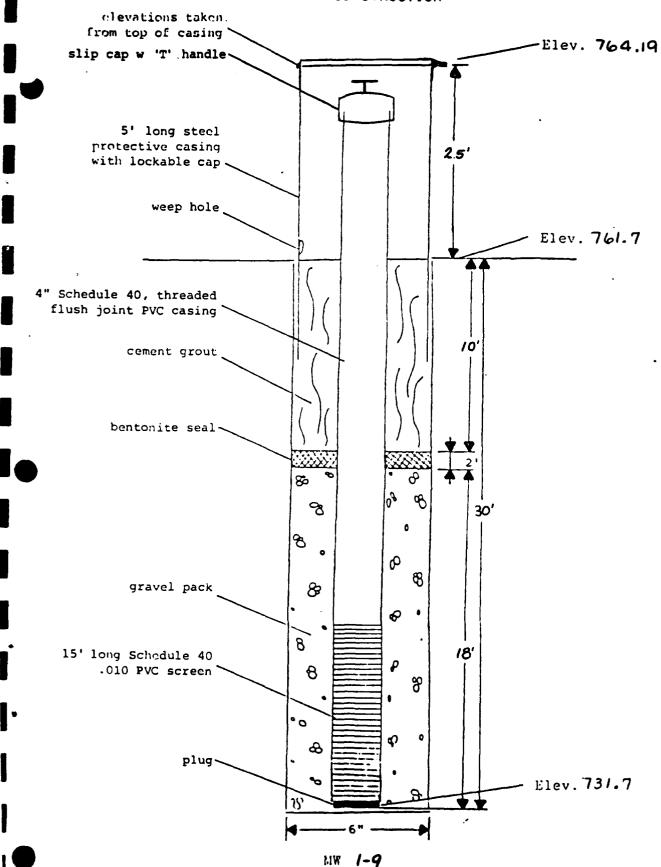




TEST	BO	RING	LOG
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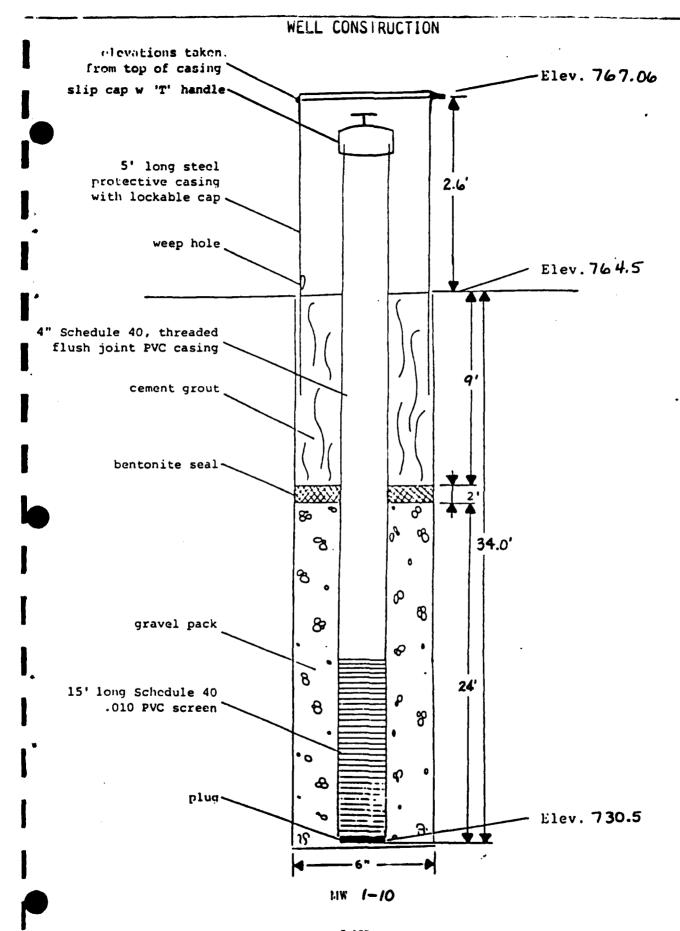
Project L	ake City	Army A	mmunitio	n Plant		Boring No
		· 				Surface Elevation 762.5 Offset
doress						Date Started 12/8/82 Completed 12/8/82
City & State	Indepen	dence,	Missour	i	·	Driller B. Blank Rig AD-2
•				At	obreviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECORD	2 }	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.5'	на				Brown silty clay w/weathered shale (fill) moist, med.
1.5'	7.5'	на				Dark brown silty clay, moist, med.
7.5'	9.51	на				Brown & gray silty clay, moist, stiff
9.5'	11.0'	ST1	1.25		1.5'	Same
11.0'	15.0'	на				Same
15.0'	19.5'	на		 		Same
19.5'	21.0'	ST2	0.75		1.2'	Brown & gray silty clay, moist, med.
21.0'	28.0'	HA				Same
28.0'	34.5'	НА				Dark gray very silty clay, moist, med.
34.5	36.0'	ST3	1.0		1.5'	Same
36.0'	Total	epth				
				· · · · · · · · · · · · · · · · · · ·		
						
					-	
	(Casing, Wate	r Loss. Et	kc.)			Water Level Time Date
,	er at 9.0					(Completion)
		· · · · · · · · · · · · · · · · · · ·				

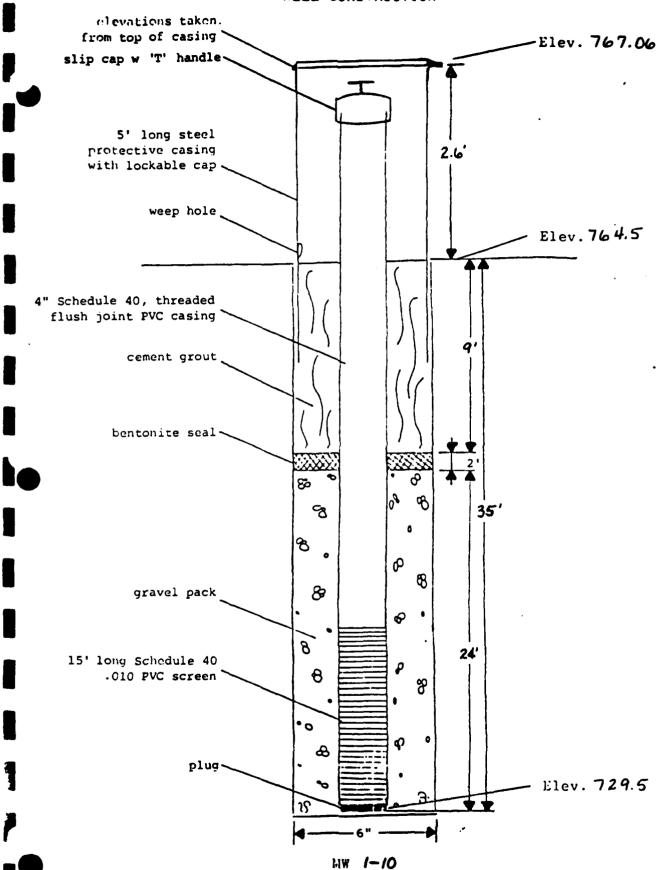




oject	Lake	City A	emy Ammu	nition Pl	ant	Boring No. MW 1-9 Sheet 1 of 1
 						Surface Elevation 761.7 Offset
.	·		· · · · · · · · · · · · · · · · · · ·			Date Started 12/9/82 Completed 12/9/82
ty & State_	Indep	endenc	e, Misso	uri		Driller B. Blank Rig AD-2
				Ab	breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wath Bore S.T. — Shefby Tube F.B. — Finger Bit
DE	PTH			TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	4.0'	на				Dark brown silty clay, moist, med.
4.0'	9.5'	на				Brown silty clay, moist, med.
9.5'	11.0'	STl	0.75	····	1.3'	Brown & gray silty clay, moist, med.
11.0'	15.0'	на				Same
15.0'	20.0'	на				Same
٥.0'	21.5'	на				Same
21.5'	24.5'	на				Dark gray silty clay, moist, stiff
24.5'	26.0'	ST2	1.25		1.5'	Same
26.0'	30.0'	HA				Same
30.0'	Total d	epth				
						•
						•
ARKS: (0	Casing, Water	Loss, Etc	:.)			Water Level Time Date
Mit wate	r at app	roximat	ely 11.0	0.		(Completion)
-		-	·			
///	l4	C .	,			•

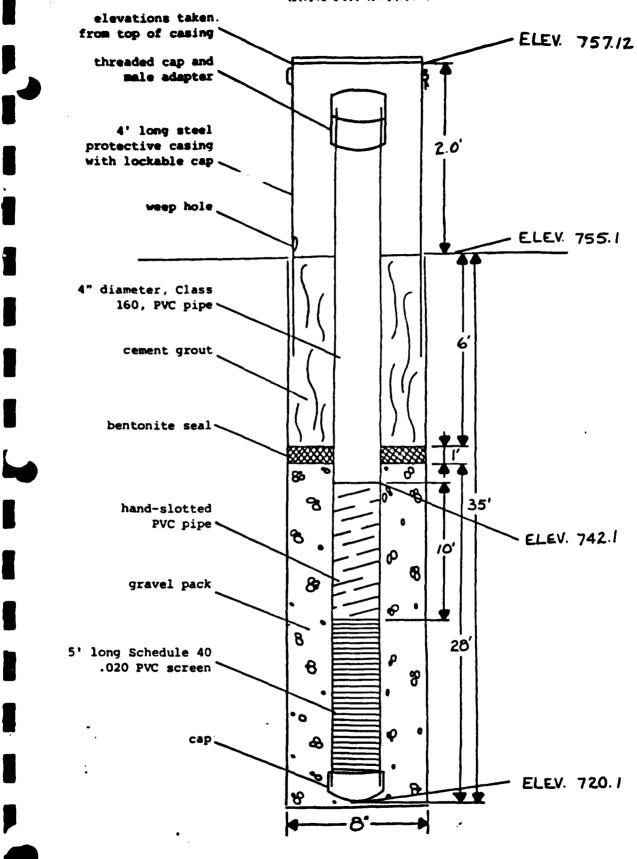
Yayne-Western Company, Inc. C-156





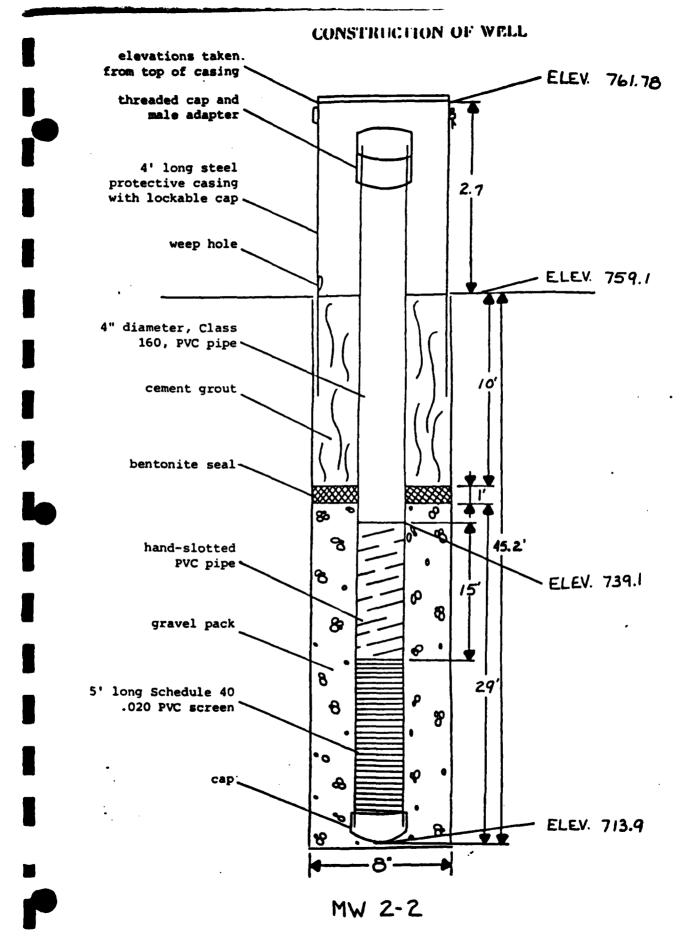
						Surface Elevation 764.5 Offset			
<u>ــ</u> ا	· ·					Date Started 1/10/83			
& State_	Indepen	dence,	Missour	i		Driller B. Blank Rig AD-2			
				At	obraviations:	A.O Auger Only R.B Rock Bit C.W Core Water H.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wash Bore S.T Shelby Tube F.B Finger Bit			
DE	РТН		PENETRA	TION RECORD	SAMPLE DESCRIPTION				
FROM	то	МЕТНОО	POCKET PENETRO. METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY			
0.0'	0.6'	на				Topsoil			
0.6'	7.5'	на				Dark brown silty clay, moist, med.			
7.5'	15.0'	на				Brown silty clay, very moist, med.			
15.0'	16.5'	STI	1.0		1.5'	Brown silty clay w/trace sand, very moist, med.			
16.5'	22.0'	на				Light brown siltyclay, moist, soft			
22.0'	35.0'	на				Light brown to gray clayey shale, moist, med			
0'	Total o	epth							
				- <u> </u>					
									
				·					
MARKS: (Casing, Water	Loss, Et	<u>. </u>			Water Level Time Date			
	·					8.2 12:00pm 1/10/83 (Completion			

CONSTRUCTION OF WELL elevations taken. from top of casing' - ELEV. 757.12 threaded cap and male adapter 4' long steel Protective casing 2.0 With lockable cap. weep hole ELEV. 755.1 4" diameter, Class 160, PVC pipe > cement grout, bentonite seal-80 8 hand-slotted 35' PVC pipe > 8 ELEV. 742.1 10' 8 gravel pack 8 € ' 8 5' long Schedule 40 2ව් .020 PVC screen В B cap. B ELEV. 727.1 MW 2-1



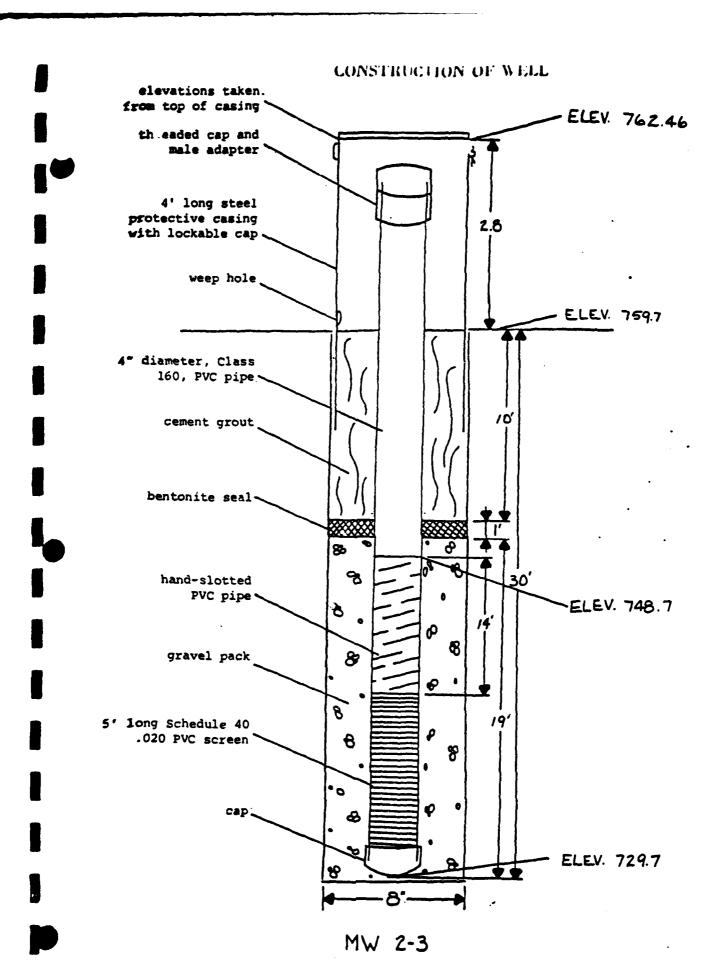
				<u>T</u>	EST BOR						
Projest	Lake	City	AAP	-,		Boring No.	NA.	2-1		Sheet_	1 of 1
7						Surface Eleve					
*dd						Date Started	8/4/81	Comp	leted _	8/4	/81
Ly & State	Indep	endenc				DrillerD.	Vogt		Rig		
•					bbrevietions:	A.O Auge H.A Holid W.B Wesh	r Only R	.B Rock	Bit acon	C.W	Core Water Core Air Finger Bis
DE	РТН			ATION RECOR	D >		SAN	APLE DESCR	IPTION	ı	:
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	∞rα	R-MATERI	AL-MOISTUR	E-CLAY	CONSIS DENSIT	TENCY
0.0'	1.0'	WB				Topsoil					
1.0'	6.0'	WB				Dark bro	own sil	ty clay	, st	lff	
6.01	10.0'	WB				Light b	rown si	lty cla	y, v	ery s	tiff
10.0'	11.5'	ST1	1.5		3.0'	Same				•	
11.5'	30.0'	WB				Same		•	-		
^2.0'	40.0'	WB				Gray si	lty cla	y, very	sti	ff	
40.01	Total	depth									
1											
							"-				
				-							
1				_				· · · · · · · ·			
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1				· · · · · · · · · · · · · · · · · · ·							•
							<u> </u>				
P"ARKS:	Casing, Water	Loss, Etc	;.)			St	atic er kevel	Time	1	Date	
Pumped	1 hour	- 2-1	/2 GPI	<u>(</u>		2	.9		9/	11/81	(Completion)
yne-ll	Vestern	Com	pany,	Inc.	C-10	62 .					

CONSTRUCTION OF WELL elevations taken. from top of casing - ELEV. 761.78 threaded cap and male adapter . 4' long steel protective casing 2.7 with lockable cap. weep hole - ELEV. 759.1 4" diameter, Class 160, PVC pipe > 10 cement grout bentonite seal -40' hand-slotted PVC pipe > 8 ELEV. 739.1 gravel pack P 8 29' 5' long Schedule 40 θ .020 PVC screen • 0 cap. B ELEV. 719.1 MW 2-2



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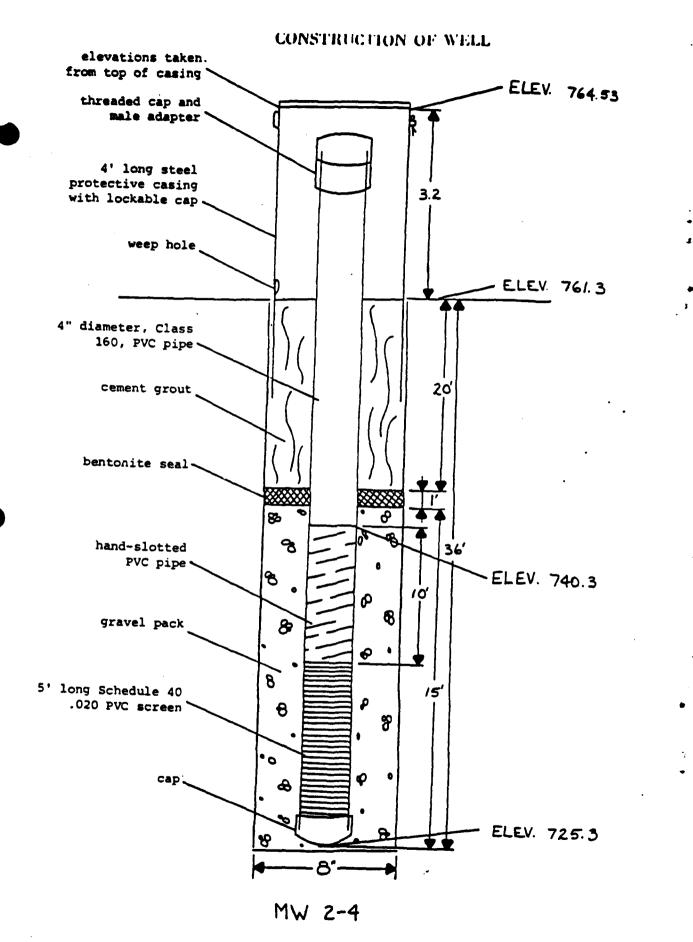
roject	Lake C	Lty AA	P			Boring No. <u>MW 2-2</u> Sheet <u>1</u> of <u>1</u>
						Surface Elevation 759.1 Offset
dd						Data Started 8/4/81 Completed 8/4/81
y & State	Indep	endenc	e, Mis	souri		Driller D. Vogt Rig
				Al	pbraviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water C.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECORE	ERY	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB				Dark brown silty clay
5.01	12.0'	WB				Brown gray silty clay, stiff
12.0'	20.0'	WB				Brown gray silty clay, soft to med.
20.0'	26.0'	WB				Gray brown silty clay, soft to med.
26.0'	36.0'	WB				Gray silty clay, soft to med.
ವರ . 0 '	40.0'	WB				Gray sandy silt w/clay seams, soft to
40.0'	Total	depth				
}						
	·					
						
				·		
MARKS: (Casing, Water Loss, Etc.)					Static Water Level Time Date 7.2 9/11/81	
mped	1 hour	- 7 G	PM .			7.2 9/11/81 (Completion)



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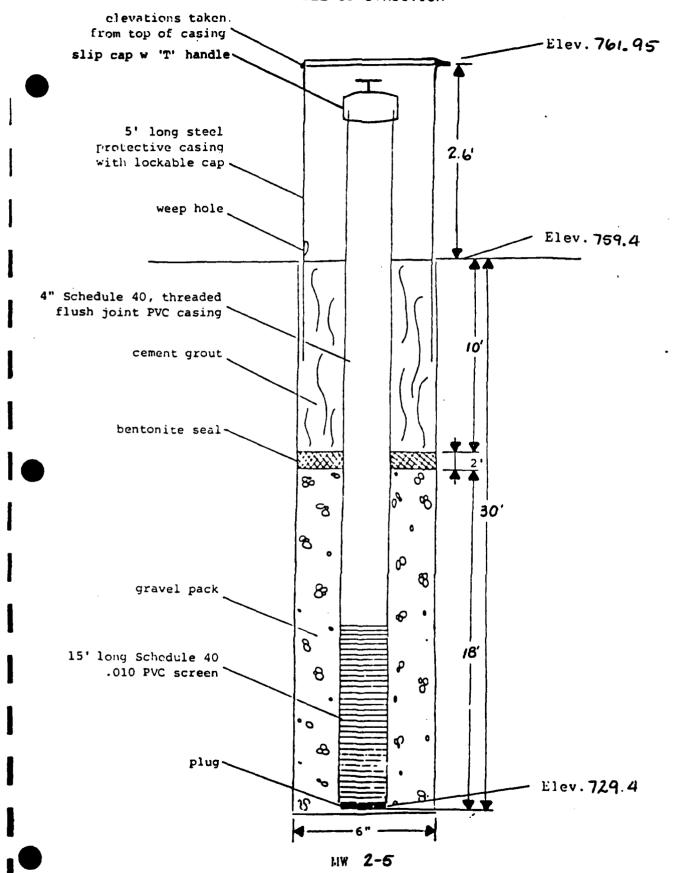
roject	Lake	City	AAP			Boring No. MW 2-3 Sheet 1 of 1
		.				Surface Elevation 759.7 Offset
						Date Started 8/7/81 Completed 8/7/81
y & State_	Indepe	ndence	, Miss	ouri		Driller D. Vogt Rig
•	•			•	bbreviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit C.W. — Core Water C.A. — Core Air S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECOR	<u>D</u>	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	WB				Topsoil
1.0'	8.0'	WB				Dark brown silty clay, med.
8.0'	10.0'	WB				Brown silty clay, med.
10.0'	11.5'	STI	1.5		1.5'	Gray brown silty clay, stiff
11.5'	30.01	WB				Gray brown silty clay, stiff
30.0'	31.5'	ST2	4.5+		1.5'	Gray brown silty clay w/sand & gravel rock, hard
1.5'	40.01	WB				Gray shale, med.
40.0'	Total	depth				
MARKS: (Casing, Water Loss, Etc.)					Static Water Level Time Date	
`.mped	2 hours	- 2	GPM			1.9 9/11/81 (Completion
yne-U	Vestern	Com	pany,/	Inc.	C-16	57



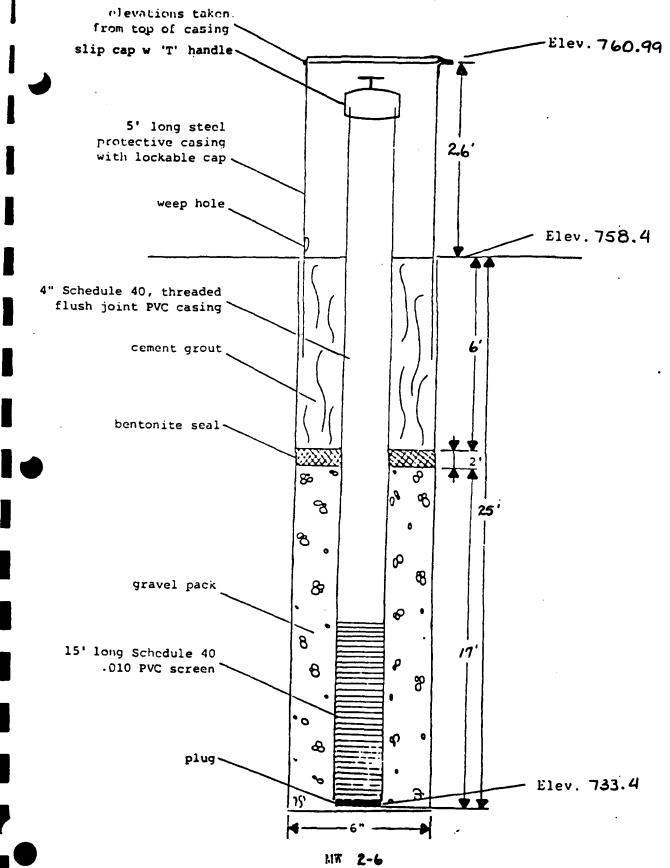
l Dject	Lake	e City	AAP			Boring No. MW 2-4 Sheet 1 of 1
						Surface Elevation 761.3 Offset
4						Date Started 8/7/81 Completed 8/7/81
y & State_	Inde	epende	nce, M	issouri		Driller T. Butler Rig
				Abb	reviațions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
DE			PENETRA	TION RECORD	ERY	SAMPLE DESCRIPTION
FROM	то	МЕТНОО	POCKET PENETRO. METER	NO. OF	CORE RECOVE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.5'	WB				Topsoil
1.5'	3.0'	WB		,		Light brown silty clay, soft to med.
3.0'	9.5'	WB				Dark gray silty clay, soft to med.
9.5'	11.0'	STI	1.5			Dark gray silty clay, stiff
11.0'	14.5'	WB				Gray silty clay, soft to med.
14.5'	19.5'	WB				Tan silty clay, soft to med.
10.5'	21.0'	ST2	1.5			Tan & gray silty clay, stiff
21.0'	22.5'	WB				Gray silty clay, med. to stiff
22.5'	29.5'	WB		-		Tan silty clay w/trace sand, soft to m
29.5'	33.5'	WB			· · · · · · · · · · · · · · · · · · ·	Tan silty clay, med. to stiff
33.5'	40.0'	WB				Tan silty clay, soft to med.
40.0'	Total	depth				
						,
MARKS: (Casing, Water	Loss, Etc	:.)			Static Water Level Time Date
rumped	1 hour	- 2-1	/2 GPM			3.0 9/11/81 _(Completion)

yne-Western Company,Inc.

WELL CONSTRUCTION

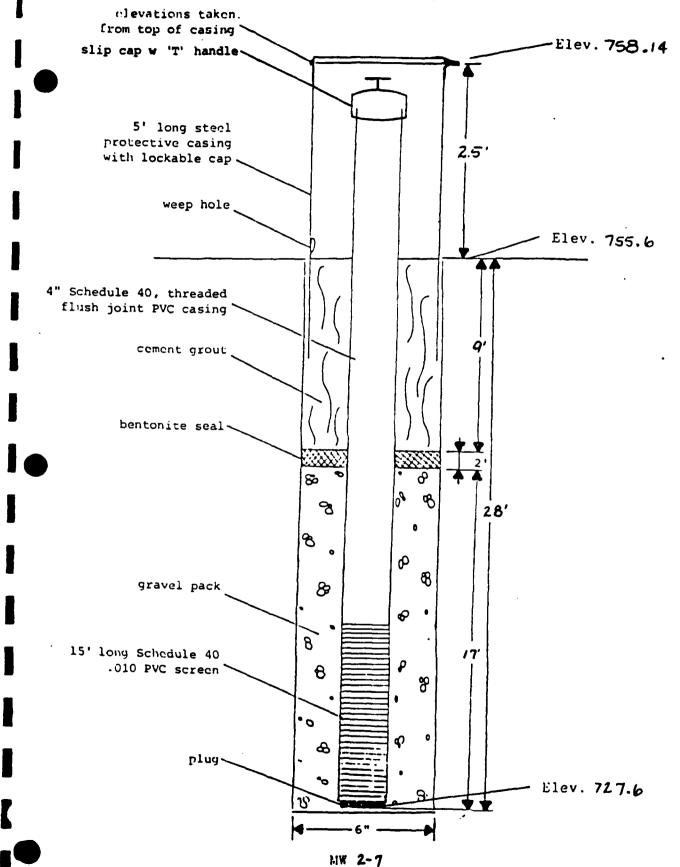


			. —			Date Started 12/9/82 Completed 12/9/82
	Indep	endence	, Misso	uri		Driller B. Blank Rig AD-2
_					previations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Wate H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH		PENETRA	TION RECORD	<u>></u>	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	0.6'	на				Topsoil
0.6'	5.0'	на				Brown silty clay, moist, med.
5.0'	9.5'	на			-	Same
9.5'	11.0'	STl	0.75		1.0'	Brown & gray silty clay, moist, med.
11.0'	15.0'	АН				Same
15.0'	20.0'	на		_		Same
.0'	22.51	на				Same
22.5'	24.5'	на				Brown & gray silty clay, moist, very stiff
24.5'	26.0'	ST2	2.25		1.5'	Same
26.0'	30.01	на			_	Same
30.01	Total d	epth				
	<u> </u>				··· · · · · · · · · · · · · · · · ·	
					<u> </u>	
		·				
SMARKS: (Casing, Water	r Loss, Et	c.)			Water Level Time Date
t wat	er at app	roxima	tely 11.	.01	<u> </u>	(Completio

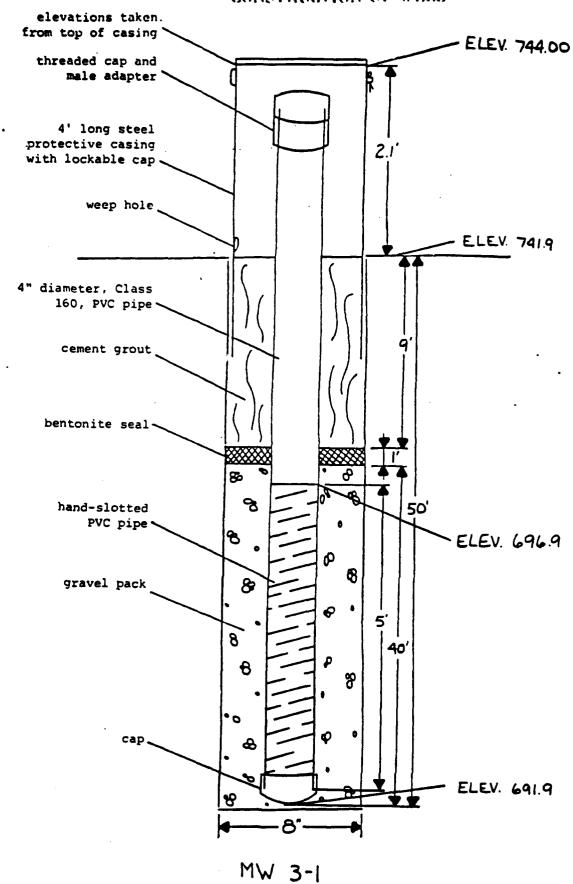


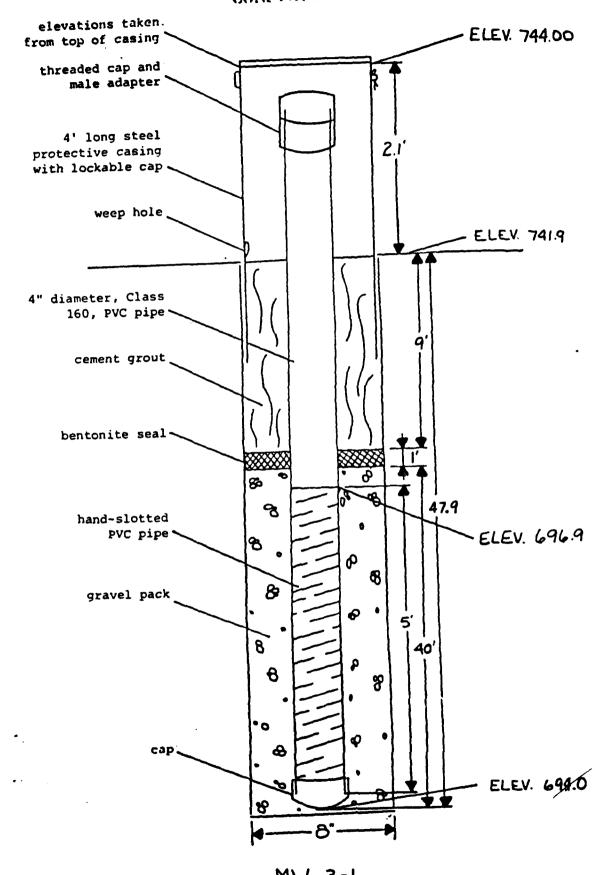
roject	Lake City	y Army	Ammunit	ion Plant		Boring No
						Surface Elevation 758.4 Offset
						Date Started 12/13/82
ty & State_	Independ	dence,	Missour	<u>i</u>		Driller B. Blank Rig AD-2
				Ab	breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Wate H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	РТН		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	на				Topsoil
1.0'	3.0'	на				Dark brown silty clay, moist, med.
3.01	5.0'	на				Brown silty clay, moist, med.
5.0'	10.0'	на				Same
10.0'	14.5'	на				Same
14.5'	16.0'	STl	4.0		1.5'	Brown & gray silty clay w/trace gravel & trace shale, very stiff
6.01	18.5'	на				Same
18.5'	25.0'	на				Brown gray silty clay, moist, med.
25.0'	Total d	epth				
,				<u> </u>		
 		 				
cMARKS.	(Casing, Wate	r Loss, E	tc.)			Water Level Time Date
			·			(Complete

WELL CONSTRUCTION



roject	are city		744441111111	ion Plant		Boring No. MW 2-7 Sheet 1 of
						Surface Elevation 755.6 Offset
doress						Date Started 1/10/83 Completed 1/10/83
ty & State	Indepe	ndence	, Missou	ıri		Driller B. Blank Rig CME-55
				Abt	previations:	A.O Auger Only H.A Hollow Auger W.B Wash Bore R.B Rock Bit S.S Split Spoon C.A Core Ai S.T Shelby Tube F.B Finger 8
DEP	TH			TION RECORD	₩	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO- METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
0.0'	0.6'	на				Topsoil
0.6'	10.0'	на				Dark brown silty clay, moist, stiff
10.0'	11.5'	STI	1.75		1.2'	Same
11.5'	13.5'	НА			-	Dark brown silty clay, very moist, soft
13.5'	18.0'	на				Brown silty clay, wet, soft
18.0'	25.0'	НА				Brown silty clay, wet, very soft
۰۵.0 ا	26.5'	ST2			0.0'	Same
26.5'	28.0'	на				Brown silty clay, very soft
28.0'	Total (epth				
	-					
					:	
JARKS: (0	Casing, Water	r Loss, E	tc.)	•		Water Level Time Date
						8.7 12:15pm 1/10/83 (Comple

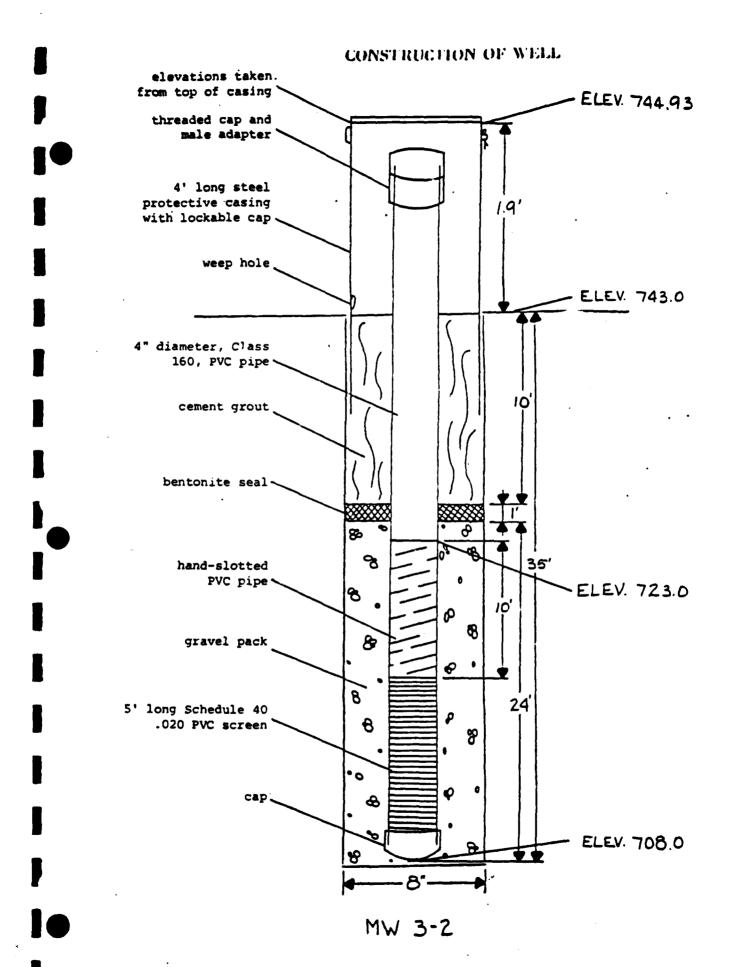


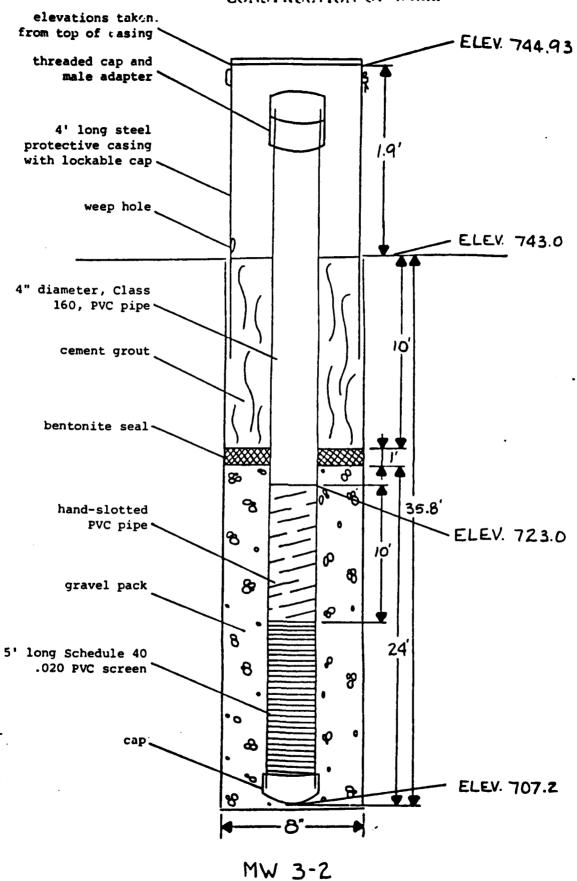


MW 3-1

TEST	80	R	ING	L	OG	ì
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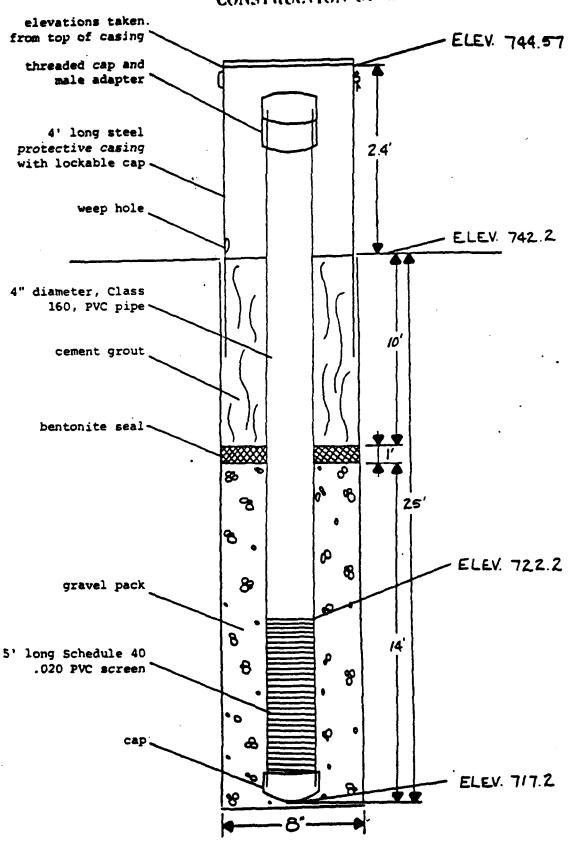
				<u> </u>		
ject	Lake C	ity AA	P			Boring No. NW 3-1 Sheet 1 of 1
						Surface Elevation 741.9 Offset
dress						Date Started 9/23/81 Completed 9/23/81
y & State	Indep	endenc	e, Mis	souri_		Driller B. Blank Rig
i .	,			. A t	obreviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Weter H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
• DE	РТН	J	<u></u>	TION RECORD	2 }	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB		·		Topsoil
1.01	5.0'	WB				Brown silty clay, very stiff
5.0'	10.0'	WB				Gray and brown fine to medium sand, med. dense
10.0'	11.0'	WB		·		Same
11.0'	15.0'	WB				Brown and gray sandy silt w/trace clay stiff
15.0'	20.01	WB			-	Same
3,	22.0'	WB			 	Same
22.0'	25.0'	WB			 	Gray and brown fine sand, loose
25.0'	30.0'	WB			 	Same
30.0'	35.0'	WB			 	Same
35.0'	40.0'	WB			<u> </u>	Same
40.0'	45.0'	WB				Gray fine sand w/trace coarse sand, med. dense
45.0'	50.01	WB				Same
50.0'	Total	depth				
j	Casing, Wate					Static Water Level Time Date
Pumped	2 hrs.	- 6 2	/3 GP N			
une-II	lestern	Com	nenu l	lnc		



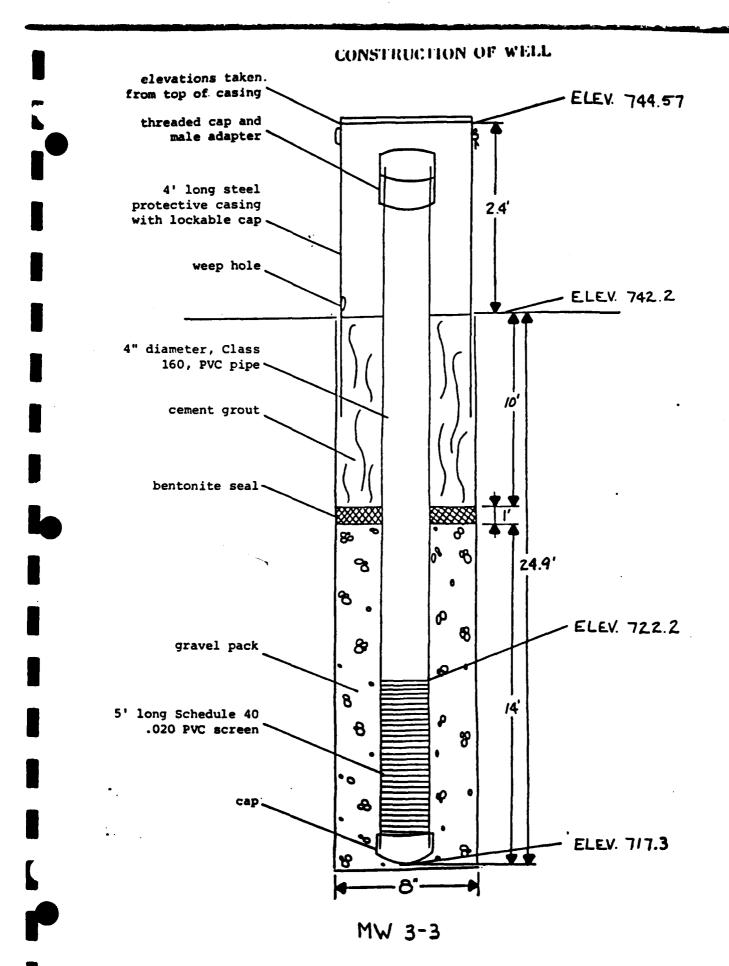


C-181 REDEVELOPMENT Z/81-

Project	Lak	e City	AAP			Boring No. <u>NW 3-2</u> Sheet 1 of 1
!	····					Surface Elevation 743.0 Offset
<u> </u>						Date Started 8/17/81 Completed 8/17/81
y & State	Inde	penden	ce, Mi	ssouri		DrillerB. Blank Rig
				Abb	revietions:	A.O Auger Only H.A Hollow Auger W.B Wesh Bore R.B Rock Bit C.W Core Water C.A: - Core Air S.T Shelby Tube F.B Finger Bit
DE	РТН			TION RECORD	ERY	SAMPLE DESCRIPTION .
FROM	то	METHOD	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB				Dark brown silty clay, stiff
5.0'	6.0'	WB				Same
6.0'	9.0'	WB		·	· · · · · · · · · · · · · · · · · · ·	Brown & gray silty clay w/trace sand, stiff
9.0'	10.5'	ST1	1.75			Same .
10.5'	15.0'	WB				Same
,'	19.0'	WB		•		Same
19.0'	20.5'	ST2				Dark brown clayey fine to med. sand, dense
20.5'	25.0'	WB				Same
25.01	30.0'	WB				Same
30.0'	35.0'	WB				Gray clayey fine sand, dense
35.0'	40.0'	WB				Same
40.0'	Total	depth				
	Casing, Woter					Static Water Level Time Date
	2 bours	- 1/2	GPM			28.3 9/10/8 Completion
					· · · · · · · · · · · · · · · · · · ·	

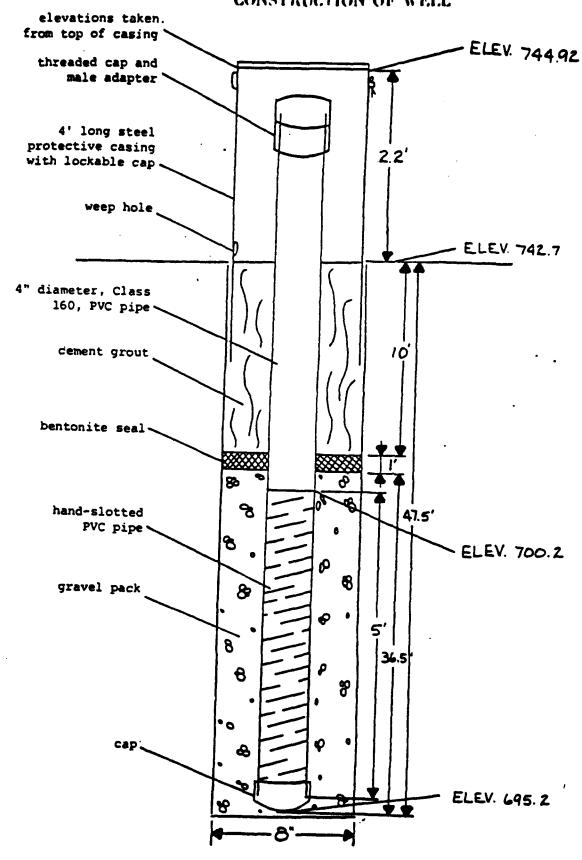


MW 3-3

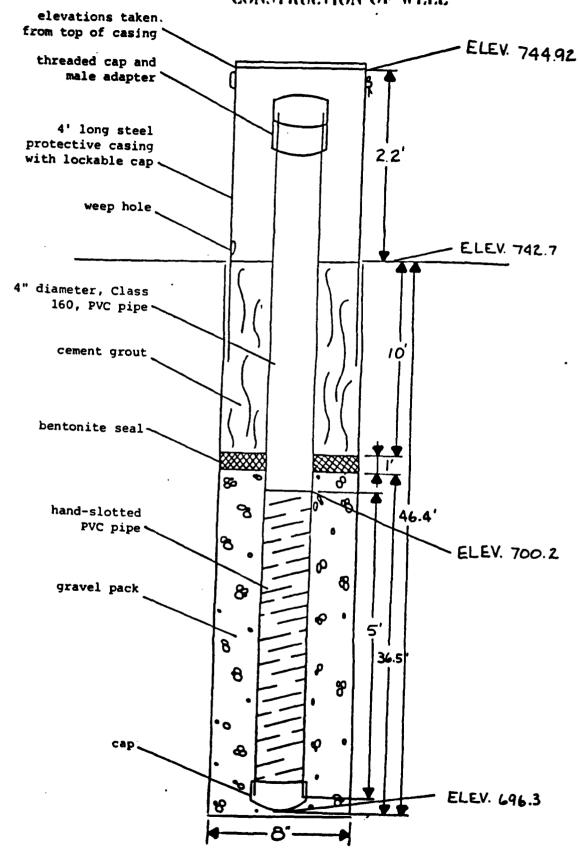


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roject	Lake C	Lty AA	P			Boring No MW 3-3 Sheet of 1
		•				Surface Elevation 742.2 Offset
المستق						Date Started 8/14/81 Completed 8/14/81
my & State_	Indep	endenc	e, Mis	ssouri		Driller T. Butler Rig
				Ab	breviations:	A.O Auger Only H.A Hollow Auger W.B Wesh Bore R.B Rock Bit S.S Split Spoon C.A Core Water C.A Core Air S.T Shelby Tube C.W Core Water C.A Finger Bit
DE	РТН			TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	4.5'	WB				Orange sandy clay, soft to med.
4.5'	8.0'	WB				Light brown sandy clay, soft
8.0'	9.51	WB				Brown & orange fine to med. sand
9.5'	11.0'	STI	1.0			Orange & brown fine to med. sand
11.0'	17.0'	WB				Brown & orange fine sand .
17.0'	18.0'	WB				Gray clay, soft to med.
18.01	24.0'	WB				Light brown fine sand
24.0'	40.0'	WB				Gray fine sand
40.0'	Total	depth				
						
'						
						Static
,	Casing, Water 1 hour					Water Level Time Date
						16.1 9/10/81 (Completion
1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-		^			 .	
yne-u	lestern	Com	pany,	Inc.	C-18	5



MW 3-4

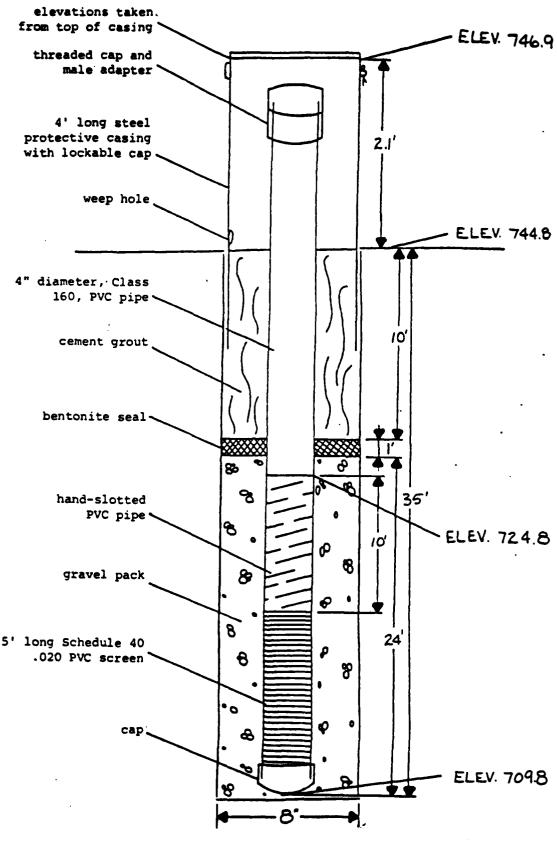


N% 3-4

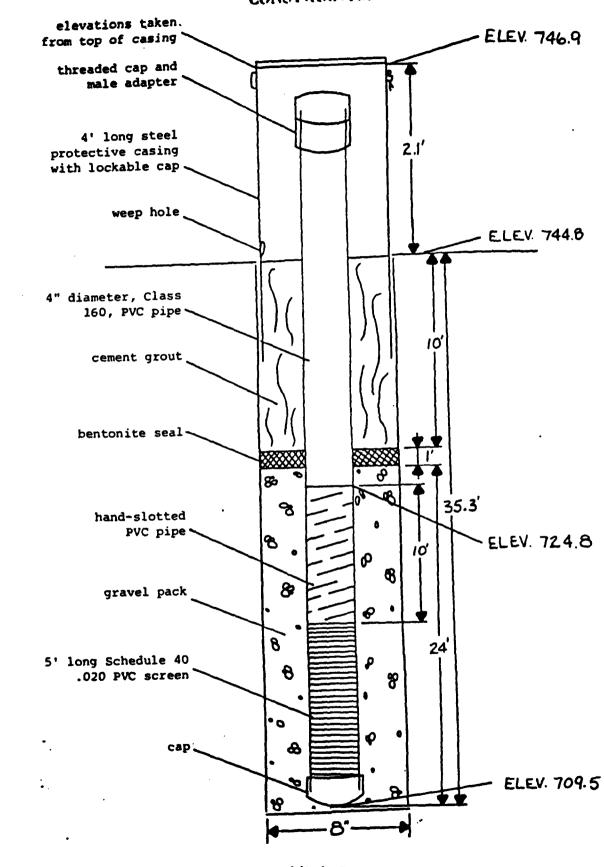
C-187 REDEVELOPMENT 2/85

roject	Lake Cit	y AAP			31 BUN	Boring No. <u><u>Y</u> 3-4 Sheet <u>1</u> of <u>1</u></u>
						Surface Elevation 742.7 Offset
^ddr <u>es</u> s						Date Started 9/22/81 Completed 9/22/81
State	Inde	pende	nce, M	issouri		Driller B. Blank Rig
					reviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Weter H.A. — Hollow Auger S.S. — Solit Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit .
DE	РТН			TION RECORD	<u></u>	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB				Topsoil
į 1.0'	5.0'	WB		,		Brown silty clay, stiff
5.0'	10.0'	WB				Gray & brown clayey silt, med.
10.0'	11.6'	WB				Same
11.6'	15.0'	WB				Brown sandy silt, med.
15.0'	20.0'	WB				Same
20.01	26.4'	WB				Same
26.4	30.0'	WB				Brown & gray sandy silt, very stiff
30.0'	33.0'	WB				Same
33.01	35.0'	WB				Gray fine sand, loose
35.0'	40.0'	WB				Same
40.0'	45.0'	WB				Gray fine sand w/trace med. sand, looss
45.0'	50.0'	WB				Same
50.01	Total	depth				
						· · · · · · · · · · · · · · · · · · ·
		,				
	Cooling, Weter					Static Water Level Time Date
	4 1.75	bours	- 7 GI	M		27.8 9/22/81 _(Completion)
		4.47	T		—- 	
in addition	Mariana and and and and and and and and and	real and a second				

C-188



MW 3-5



MW 3-5

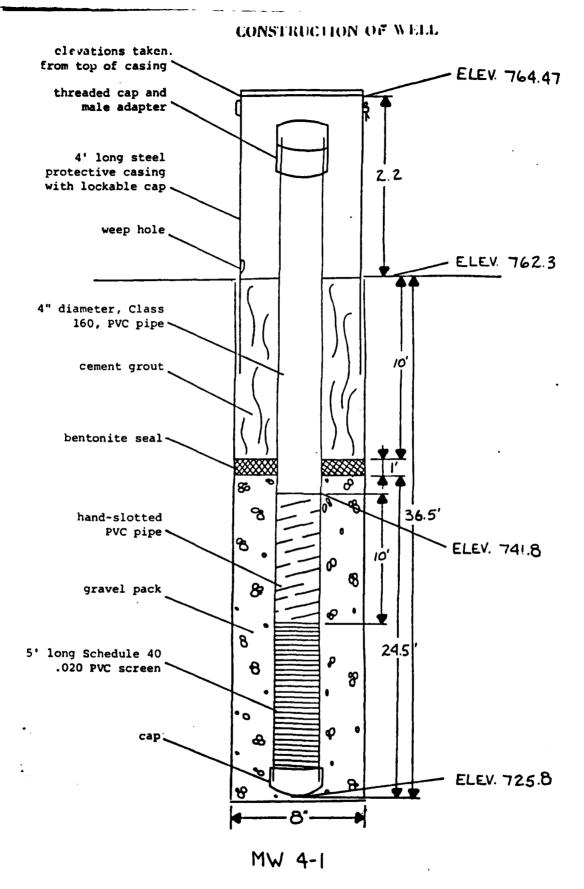
C-190

TEST	BORIN	G LOG
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				-		ING LOG
ojectI	Lake Cit	ty AAP				Boring No. <u>MW 3-5</u> Sheet <u>1 of 1</u>
						Surface Elevation 744.8 Offset
idress						Date Started 8/13/81 Completed 8/14/81
y & State_	Indep	endenc	e, Mis	ssouri		Driller B. Blank Rig
				Ab	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore S.S. — Split Spoon S.T. — Shelby Tube C.W. — Core Water C.A. — Core Air F.B. — Finger Bit
	PTH			ATION RECORD	₽	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER NO. OF BLOWS	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB				Brown silty clay, very stiff
5.0'	9.5'	WB				Dark brown clayey sand, med. dense
9.5'	11.0'	SS1		3-5-5	1.4'	Same
11.0'	13.0'	WB				Same .
13.0'	15.0'	WB		•		Gray & brown silty clay w/trace sand, very stiff
15.0'	20.0'	WB				Same
20.0'	25.0'	WB				Same
25.0'	28.0'	WB		:		Brown silty sand w/trace clay, med. de
28.0'	29.5'	WB		:		Same
29.5'	31.0'	SS2		3-5-5	1.4'	Same
31.0'	32.0'	WB				Same
32.0'	35.0'	WB				Blue gray sandy silt, very stiff
35.0'	40.0'	WB				Same
40.0'	Total	depth				
MARKS: (Casing, Wate	r Loss, Etc	<u> </u> .)			STRTIC Water Level Time Date
umped	1-1/2	hour -	2 GP1	Y		30.4 9/10/81 (Completion)

yne-Western Company,Inc.

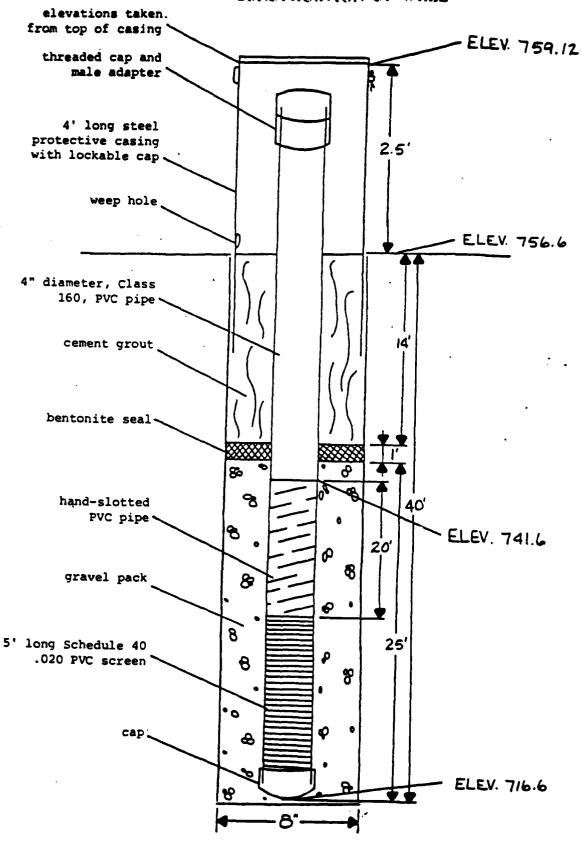
CONSTRUCTION OF WELL clevations taken. from top of casing' - ELEV. 764.47 threaded cap and male adapter 4' long steel protective casing 2.2 with lockable cap. weep hole ELEV. 762.3 4" diameter, Class 160, PVC pipe cement grout 10' bentonite sealhand-slotted 35.5 PVC pipe > 8 ELEV. 741.8 10' 8 gravel pack 8 8 5' long Schedule 40 24.5 .020 PVC screen 80 cap. B ELEV. 726.8 MW 4-1



C-193 REDENSLAMENT 2/85

				TE	ST BOR	ING LOG		
Project	Lake Ci	ty AAP				Boring No		
						Surface Elevation 762.3 Offset		
*dds						Date Starred 8/11/81 Completed 8/12/81		
JAV & State	Inde	penden	ce, Mi	ssouri		Driller B. Blank Rig		
					previations:	A.O — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit		
DE	РТН		PENETRATION RECORD		₹	SAMPLE DESCRIPTION		
FROM	то	METHOD	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY		
0.0'	1.0'	WB				Topsoil		
1.0'	5.0'	WB				Gray & brown silty clay, very stiff		
5.0'	9.5'	WB				Same		
9.5	11.0'	ST1	2.5		1.0'	Same		
11.0'	15.0'	₩B				Same .		
-5.01	20.0'	WB			.	Gray & brown silty clay w/trace sand & gravel, very stiff		
- 30°	25.0'	WB				Same		
25.0'	30.0'	WB				Same		
30.0'	35.01	WB				Same		
35.0	36.0'	WB				Same		
36.0'	40.0'	WB				Yellow brown silty clay w/trace sand, very stiff		
40.0'	Total	depth						
				_				
MARKS:	(Casing, Wate	r Loss, Etc	i.)			Static Water Level Time Date		
Pumped	2 hours	- 1/	2 GPM			18.9 9/11/81 _(Completion)		

yne-Western Company,Inc.



MW 4-2

oct	Lake	City	AAP			Boring No. <u>MW 4-2</u> Sheet <u>1</u> of <u>1</u>
						Surface Elevation 756 . 6 Offset
						Date Started 8/24/81 Completed 8/25/81
& State	Indepe	endenc	e, Mis	souri		Driller Rig
				Abt	previations:	A.O Auger Only R.B Rock Bit C.W Core Water M.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wesh Bore S.T Shelby Tube F.B Finger Bit
DE	РТН			TION RECORD	Α.	SAMPLE DESCRIPTION *
FROM	то	METHOD	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.01	0.51	WB				Topsoil
0.5'	7.0'	WB				Dark brown silty clay, soft
7.0'	9.5'	MB				Gray silty clay, soft
9.5'	11.0'	ST1	1.0			Gray clayey silt, soft
11.0'	16.0'	WB				Same .
6.0'	19.5'	₩B				Light tan silty clay, soft
5'	21.0'	ST2	2.0			Gray silty clay w/trace sand, soft to
21.0'	29.5'	WB				Gray sandy clay, soft to med.
29.5'	39.5'	WB				Same
39.5'	41.0'	SS1				Same
11.0'	Total	depth				
					-	
ARKS: (Casing, Water	Loss, Etc)			STRTIC Water Level Time Date
mped	2 hours	- 1/	2 GPM			
						· .

yne-Western Company,Inc.

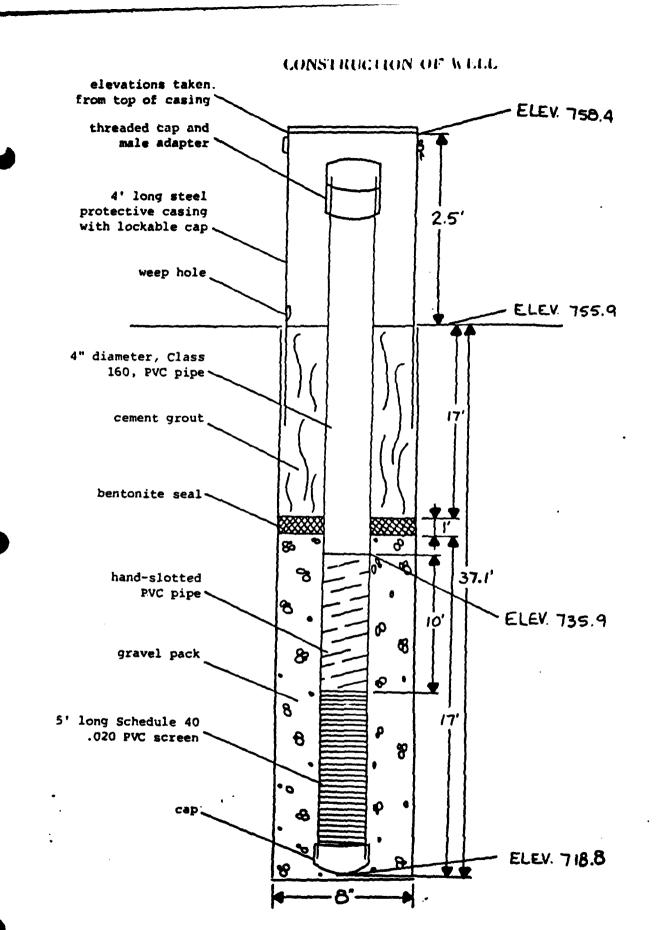
CONSTRUCTION OF WELL elevations taken. from top of casing - ELEV. 758.4 threaded cap and male adapter ` 4' long steel protective casing 2.5 with lockable cap. weep hole ELEV. 755.9 4" diameter, Class 160, PVC pipe > cement grout 17 bentonite seal -8 hand-slotted 35' PVC pipe -જ ELEV. 735.9 10' gravel pack 8 ₽ 8 5' long Schedule 40 17' .020 PVC screen 8 80

MW 4-3

ELEV. 720.9

• 0

cap;

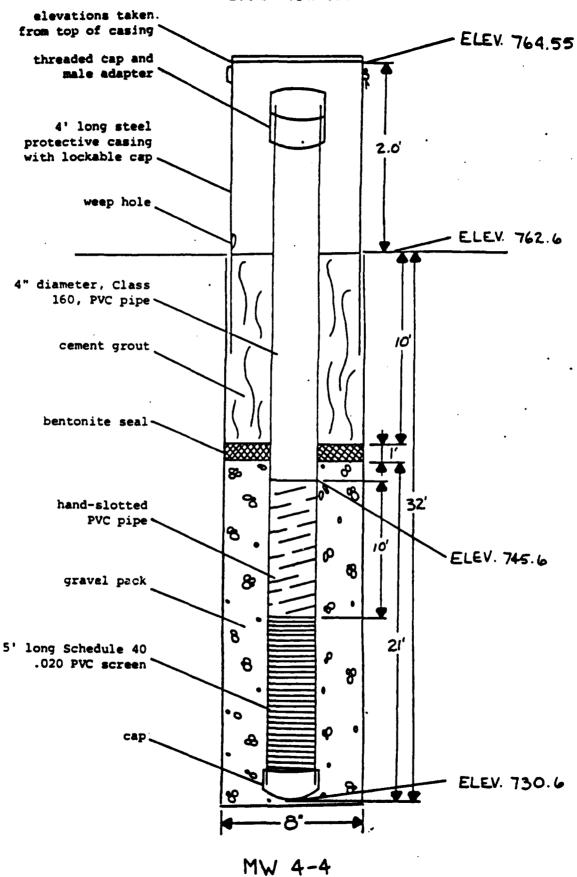


MW 4-3

ProjectL	ake Cit	y AAP			ST BOR	Boring No Sheet1 of _1			
r		· · · · · ·	:			Surface Elevation 755.9 Offset			
^dd						Date Started 8/12/81 Completed 8/12/81			
y & State	Indep	endenc	e, Mis	souri		Driller T. Butler Rig			
				Abb	revietions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit			
DE	PTH		PENETRA	PENETRATION RECORD		SAMPLE DESCRIPTION			
FROM	то	МЕТНОО	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY			
0.0'	1.0'	WB				Topsoil			
1.0'	7.5'	WB				Dark brown silty clay, soft to med.			
7.5'	9.5'	WB		·		Brown silty clay, med. to stiff			
9.5'	11.0'	ST1	4.5			Brown silty clay, very stiff			
11.0'	12.5'	WB				Brown silty clay, stiff			
`2.5'	17.0'	WB				Light gray silty clay, soft to med.			
17.0'	19.5'	₩B				Light brown silty clay, soft to med.			
19.5'	21.0'	ST2	1.0			Light gray silty sandy clay, med.			
21.0'	23.0'	WB				Light gray silty sandy clay, soft to me			
23.0'	28.0'	WB				Light gray silty clay w/trace sand, soft to med.			
28.0'	33.5'	WB				Light gray silty clay w/trace sand, so			
33.5'	34.5'	WB				Light gray silty clay w/trace sand & weathered shale, soft to med.			
34.5'	40.0'	MB				Light brown sandy clay, soft to med.			
40.0'	Total	depth							
					·				
'ARKS:	(Casing, Wats	r Loss, Etc	2.)			STATIC Water Kevel Time Date			
Pumped	1-1/2	bour -	1 GPM			8.0 9/11/81 (Completion)			
lacena .//	llage-	Cam	mamu :	les.					

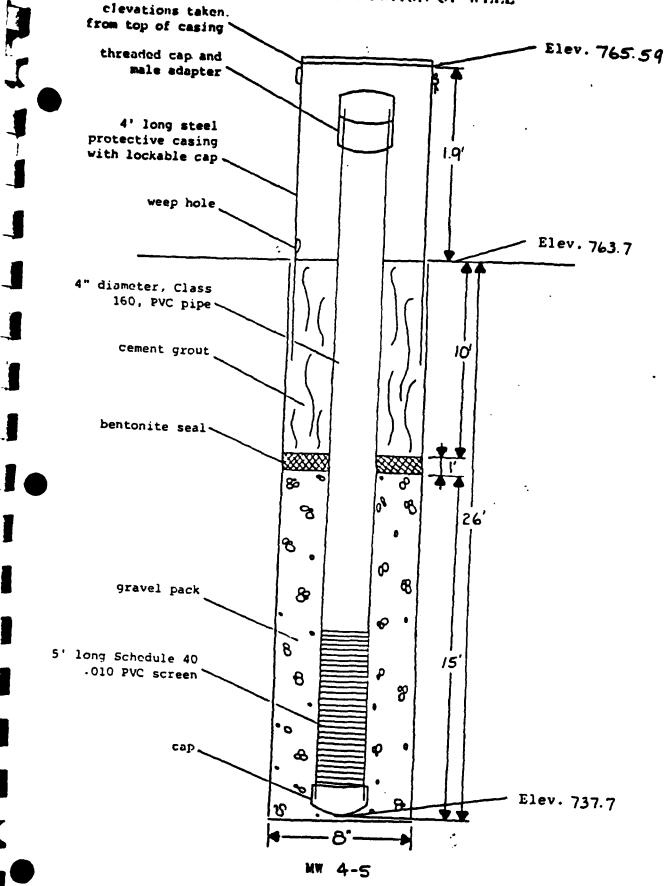
C-199



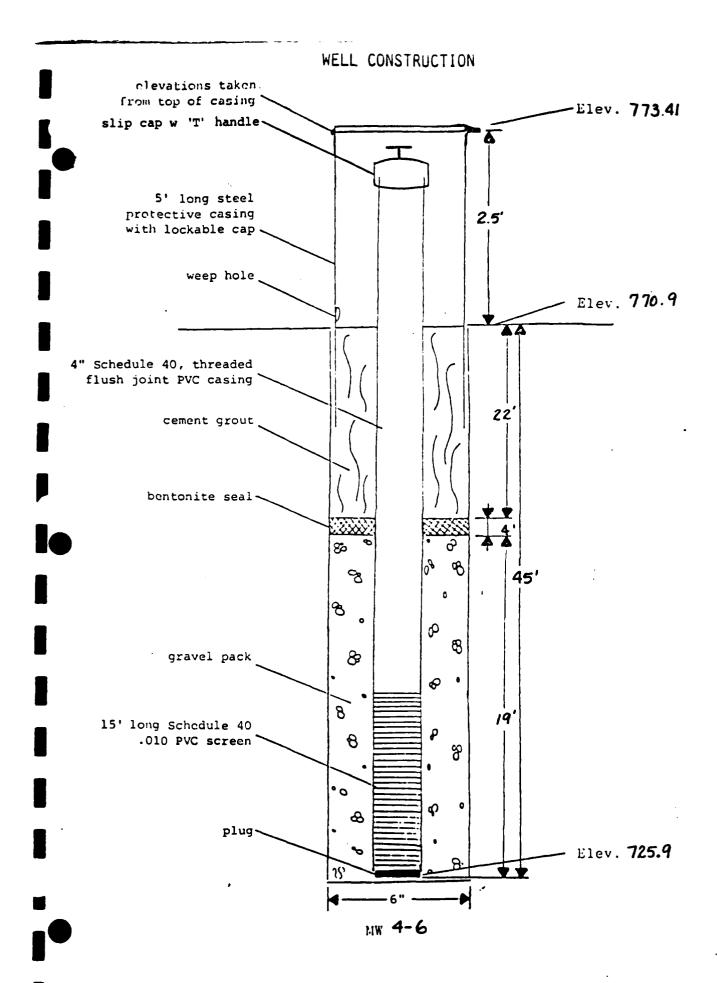


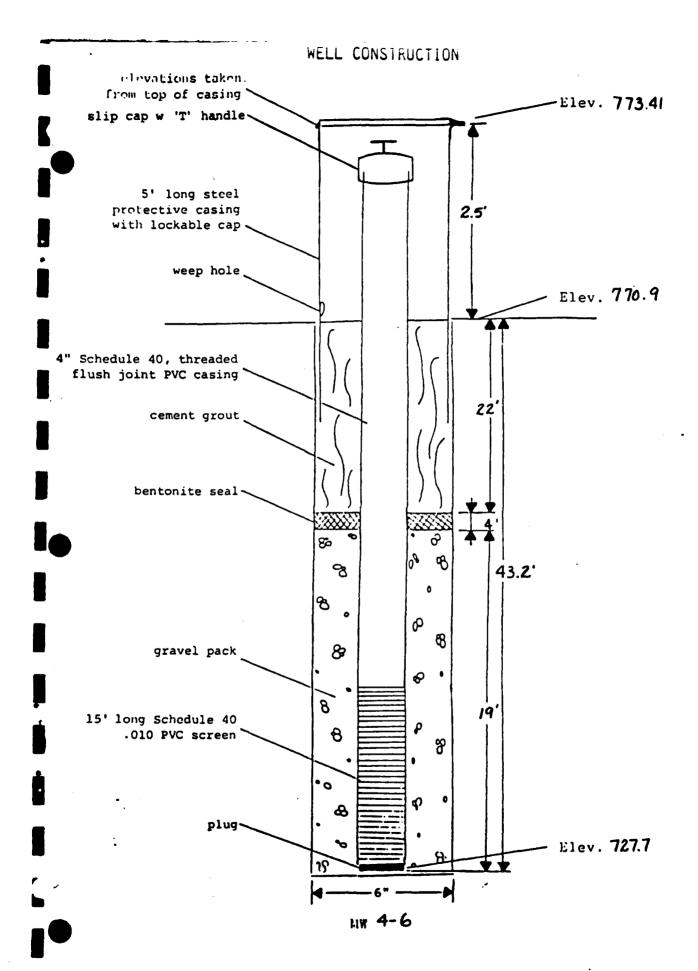
TEST	BOR	IN	GL	OG

roject	Lake	City A	AP			Boring No. MW 4-4 Sheet 1 of 1			
						Surface Elevation 762.6 Offset			
Y & State	Inde	penden	ce, Mi	ssouri		Date Started 8/12/81 Completed 8/13/8 B. Blank			
y & State_				Ab	obreviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Weet H.A. — Hollow Auger S.S. — Solit Spoon C.A. — Core Air W.B. — Weeh Bore S.T. — Shelby Tube F.B. — Finger Bit C.W. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Air C.A. — Core Bit C.A. — Core Bit C.A. — Core Bit C.A. — Core Bit C.A. — Core Bit C.A. — Core Bit C.A. — Core Weet C.A. — Core Bit C.A. — Core Weet C.A. — Core Weet C.A. — Core Bit C.A. — Core			
DE	PTH			TION RECORD	<u>}</u>	SAMPLE DESCRIPTION			
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY			
0.0'	1.0'	WB				Topsoil			
1.0'	5.0'	WB		,		Gray & brown silty clay, very stiff			
5.0'	10.0	WB				Same			
10.0'	15.0'	WB				Same			
15.0'	19.01	WB				Same .			
י9.0'	20.5'	ST1	1.5		1.3'	Gray & brown silty clay w/trace sand stiff			
20.51	25.0'	WB				Same			
25.0'	30.0'	WB				Brown & gray silty clay w/trace sand gravel, very stiff			
30.0'	35.0'	WB				Same			
35.0'	36.0'	WB				Same			
36.0'	40.0'	WB				Brown silty clay, very stiff			
40.0'	Total	depth							
	Cesing, Water 2 hours					Static Water Level Time Date 13.8 9/11/84(Completic			



jec1 <u>L</u> .	ake City A	Army An	munitio	n Plant	Boring No. MW 4-5 Sheet 1 of 1	
						Surface Elevation Offset
						Date Started 1/21/82 Completed 1/21/82
& State_	Independ	lence.	Missour	<u> </u>		Driller T J Butler Rig D-2
				Abb	previations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit C.W. — Core Water C.A. — Core Air F.B. — Finger Bit
DE	РТН			TION RECORD	حمة ا	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NÒ OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
0.01	7.5'	WB_				Light brown & gray silty clay, med to stiff
7.5'	10.0'	WB				Same
10.0'	15.0'	WB				Same
15.0'	20.0'	WB			***************************************	Same
20.0'	29.5'	WB				Gray silty clay, very soft to soft
29.5'	40.0'	WB				Gray silty clay, stiff to medium
0 .0'	Total De	pth				
	(Casing, Water			steadily		Water Level Time Date Before Pumping 1/25/82(Completion





Project La	ke City A	rmy Am	munitio	n Plant		Boring No. TH 1 Sheet 1 of 2
						Surface Elevation 761.5 Offset
La La	ke City P	lant				Date Started 9/26/83 Completed 9/26/83
City & State_	Indepe	ndence	, Misso	uri		Driller M. L. Blank Rig D-12
				Ab	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit S.S. — Split Spoon C.A. — Core Water C.A. — Core Air F.B. — Finger Bit
DE	РТН			ATION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FHOM	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY .
_0,0'	1.0'	на				Brown silty clay, moist, very stiff
1.0'	2.5'	SS1		5-7-10	0.3'	Brown & dark brown gray silty clay, fill, iron stains, moist, very stiff
2,51	4.0'	SS2		6 - 6-6	1.5'	Gray & brown silty clay w/iron stains, trace of roots & small rock, fill, moist, stiff
4, ₀ ,	5.5'	SS3		6-7-10	1.5'	Gray & brown very silty clay, w/iron stains, trace small rock, moist, very stiff
5,51	7.0'	SS4_		3-6-7	1.5'	Gray very silty clay w/iron stains, moist, stiff
4.01	8.5'	SS5		4-6-10	1.5'	Same
<u>b</u> ,5'	10.0'	SS6		3-6-8	1.5'	Same
۱۵٬۵۰	11.5'	SS7		3-6-9	1.5'	Gray w/brown silty clay, w/iron stains, moist stiff (possible fill)
11,5'	13.0'	SS8		3-5-5	1.5'	Gray very silty clay w/ iron stains, moist, stiff (increasing moisture content)
13.0	14.5'	SS9		2-4-6	1.5'	Same
14.5'	16.0'	SS10		2-4-4	1.5'	Gray fine sandy silty clay, w/trace iron stain & small rock, moist, medium (possible fill?)
lt.g·	17.5'	SS11		2-4-6	1.5'	Gray very silty clay, trace fine sand & small rock, moist, stiff, (possible fill?)
17,5'	19.0'	SS12		2-5-6	1.5'	Gray w/trace brown very silty clay, trace irostains, moist, stiff (possible fill?)
74, <u>0'</u>	20.5'	SS13		3-4-6	1.5'	Gray w/trace brown very silty clay, becoming sandier w/depth, moist, stiff
<u>.ن، 5 ۰</u>	22.0'	SS14		2-4-5	1.5'	Gray w/trace brown silt, traces of fine sand & clay, moist, stiff
<u>_22</u> .0'	23.5'	SS15		3-3-5	1.5'	Gray w/trace brown clayey silt, trace iron stains, moist, medium
ARKS:	(Casing, Water	Loss, Et	, c.)			Water Level Time Date
						(Completion)
1 . ,		_				C=206

roject <u>L</u>	ake City A	Army Am	munitio	on Plant		Boring No			
l	····	·				Surface Elevation Offset			
5.00						Date Started Completed			
y & State						DrillerRig			
				Аы	breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit			
DE	EPTH	T	PENETR	ATION RECORD	>	SAMPLE DESCRIPTION			
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY			
23.5'	25.0	SS16		4-5-7	1.5'	Gray w/trace brown silt, w/traces of clay, moist, stiff			
25.0'	26.5'	SS17		3-4-5	1.5'	Gray silt, w/traces of clay in upper zone, ver moist, (increasing moisture w/depth), stiff			
26.5'	28.01	SS18		2-3-6	1.5'	Gray clayey silt, moist, stiff .			
28.0'	29.5'	SS19		3-4-4	1.5'	Gray clayey silt, trace fine sand, wet pockets in soil, very moist, medium			
29.5'	31.0'	SS20		4-6-7	1.5'	Gray clayer 'lt, w/rocky zones (chert) lime- stone, very moist, stiff			
31.0'	32.5'	SS21		2-4-5	1.5'	Gray silt, trace of clay & fine sand, moist, stiff			
32.5'	34.0'	SS22		5-6-6	1.5'	Brown gray clayey silt, w/traces fine sand, moist, stif. (sampler wet)			
34.0'	35.5'	SS23		4-5-6	1.5'	Brown gray clayey silt, trace fine sand, iron nodules & stains, moist, stiff			
35.51	37.0	SS24		2-4-6	1.5'	Gray clayey silt, w/iron stains & nodules, w/traces of rock, moist, stiff			
37.0'	38.5'	SS25		4-5-7	1.5'	Brown clayey silt w/traces of rock, moist, stiff			
38.5'	40.0'	SS26		3-5-6	1.5'	Brown w/traces of gray clayey silt, moist, stiff			
40.0'	Total	epth							
ARKS:	(Casing, Water	Loss, Etc	:.)			Water Level Time Date			
	·					(Completion)			

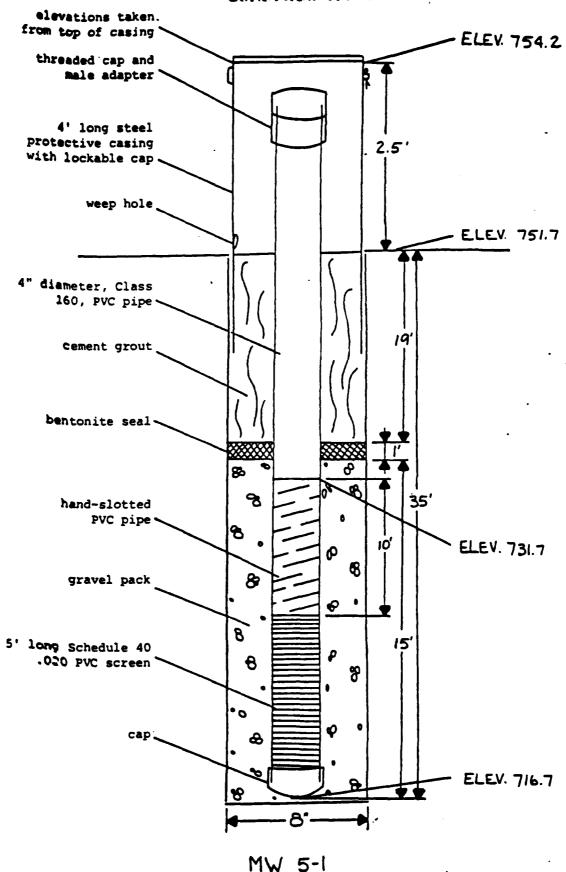
□ □roject <u>La</u>	ke City A	rmy Amu	nunitio	n Plant	· -	Boring No
						Surface dievation 770.9 Offset
Arithus	Lake City	Plant				Date Started 9/27/83 Completed 9/27/83
City & State_	Independe	ence, N	lissour	i		Driller M. L. Blank Rig D-12
				Abi	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit S.S. — Split Spoon C.A. — Core Water C.A. — Core Air S.T. — Shelby Tube F.B. — Finger Bit
DE	РТН		PENETR	ATION RECORD	≥	SAMPLE DESCRIPTION
FROM	то	МЕТНОО	POCKET PENETRO. METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	на				Topsoil
1.0'	2.5'	SS1		5-5-5	0.5'	Gray brown clayey silt, trace of roots, slightly moist, sriff
2.5'	4.0'	SS2		6-4-3	0.5'	Gray brown clayey silt, trace of roots, slightly moist, medium
4.0'	5.5'	SS3		2-2-4	0.8'	Gray & brown very silty clay, trace of dark & iron stains, moist, medium (fill)
5.5'	7.0'	SS4		6-4-6	1.5'	Gray & brown very silty clay, trace of dark & iron stains, moist, stiff (fill)
7.0'	8.5'	SS5		2-4-5	1.5'	Gray w/brown very silty clay w/gray clay pocke trace of roots, moist, stiff (fill)
8.5'	10.0'	SS6		2-4-6	1.5'	Gray w/brown very silty clay w/gray clay pocke w/dark nodules, moist, stiff (fill)
10.0'	11.5'	SS7		3-4-7	1.5'	Same ,
11.5'	13.0'	SS8		4-6-8	1.5'	Brown w/gray very silty clay, trace of dark nodules, moist, stiff (fill?)
13.0'	14.5'	SS9		2-5-6	1.5'	Brown & gray very silty clay, tr. of dark nodul & iron stains, moist, stiff
14.5'	16.0'	SS10		2-4-6	1.5'	Brown & gray very silty clay, tr.of dark nodule & iron stains, sand & small rock, moist, stiff
16.0'	17.5'	SS11		3-4-6	1.5'	Same
17.5'	18.5'	SS12		1-7-9	1.5'	Gray very silty clay, traces of dark nodules, fine sand & small rock, moist, very stiff
18.5'	20.0'	SS13		2-10-14	1.5'	Gray very silty clay, traces of dark nodules, & iron stains, moist, very stiff
20.0'	21.5'	SS14		4-7-10	1.5'	Same
21.5'	23.0'	SS15		4-8-12	1.5'	Gray & brown very silty clay, dark & iron stains, moist, very stiff
FMARKS:	Casing, Water	Loss, Et	, c.)			Water_Level Time Date
				w/auger	s in	28.3' 2:15 pm 9/27/83 (Completion)
			·			20.5' 10:00 am 9/28/33

oject	Lake City	Army A	mmunit	ion Plant		Boring No. <u>TH 2 & MW-4-6</u> Sheet <u>2</u> of <u>3</u>		
			<u> </u>			Surface Elevation Offset		
poress						Date Started Completed		
ty & State_			`			Driller Rig		
				Abl	breviations:	A.O Auger Only H.A Hollow Auger W.B Wash Bore R.B Rock Bit C.W Core Water C.A Core Air F.B Shelby Tube F.B Finger Bit		
DEI	РТН		PENETR	ATION RECORD	ERY	SAMPLE DESCRIPTION		
FROM	то	МЕТНОВ	POCKET PENETRO- METER	NO. OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY		
23.0'	24.5'	SS16		5-8-11	1.5'	Gray & brown very silty clay, dark & iron stains, moist, very stiff		
24.5'	26.0'	SS17		4-7-8	1.5'	Same (sample gets grayer w/depth)		
26.0'	27.5'	SS18		3-6-10	1.5'	Brown & gray very silty clay, traces of iron & dark stains, moist, stiff		
27.5'	29.0'	SS19		4-8-12	1.5'	Brown & gray very silty clay w/dark stains, traces of iron stains, moist, stiff		
29.0'	30.5'	SS20		5-8-12	1.5'	Brown & gray very silty clay, traces of small rock & iron nodules, moist, very stiff		
30.5	32.0'	SS21_		4-8-12	1.5'	Brown & blue gray very clayey silt w/dark sta moist, very stiff		
32.0'	33.0'	на				Same		
33.0'	34.5'	SS22		4-7-11	1.5'_	Brown & gray clayey silt w/dark & icon stains moist, very stiff		
34.5'	36.0'	SS23		4-6-9	1.5'	Brown & gray clayey silt w/dark & iron stains w/traces of small rock, moist, very stiff		
36.0'	37.5'	SS24		2-5-8	1.5'	Same		
37.5'	39.0'	SS25		5-6-10	1.5'	Brown & gray clayey silt w/dark & iron stains w/traces small rock & fine sand, moist, v. st		
39.0'	40.5'	SS26		5-6-10	1.5'	Same		
40.5'	42.0'	SS27		6-8-11	1.5'	Same (Note: rock is concentrated in zones in sample & is mostly chert)		
42.0'	43.5'	SS28		3-7-9	1.5'	Brown & gray sandy clayey silt, w/dark & iron stains, traces of small rock, moist, ver		
						stiff (water on sampler)		
43.5'	45.0'	SS29		4-7-8	1.5'	Brown & gray sandy clayey silt w/dark & iron stains, w/lots of rock & sandy zones, mo		
MARKS: (Casing, Wate	r Loss, Et	ć.)			Very Stiff Water Level Time Date		
						(Completion		
		_	-					

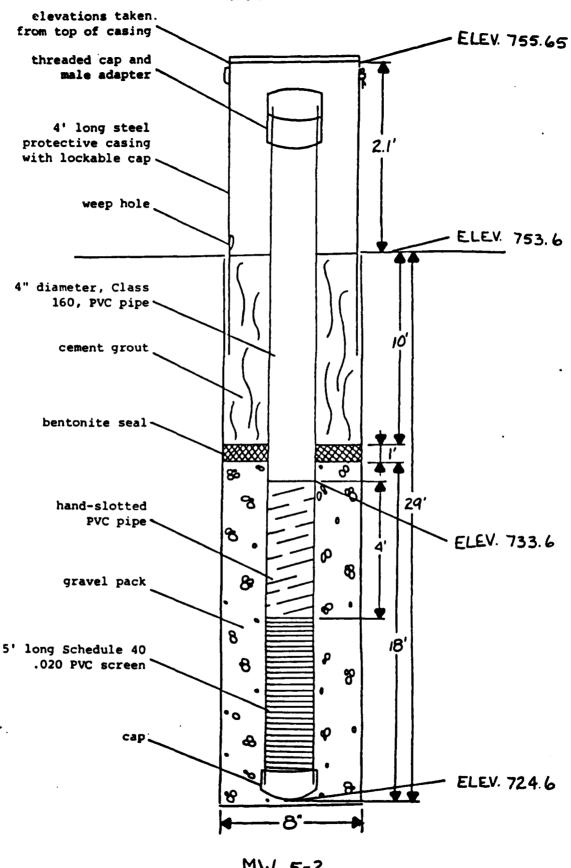
Project <u>La</u>	ke City A	army Am	munitio	on Plant		Boring No. TH 2 & MW-4-6 Sheet 3 of 3
7						Surface Elevation Offset
Ar S						Date Started Completed
Sty & State						DrillerRig
					breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shetby Tube F.B. — Finger Bit
DE	РТН		PENETR	ATION RECORD	<u></u>	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
45_Q'	46.5'	SS30		5-8-10		Brown & gray sandy clayey silt w/dark & iron stains, w/lots of rock & sandy zones, movery stiff
46.5'	48.0'	SS31		2-3-5	1.5'	Brown & gray sandy clayey silt w/dark & iron stains, w/lots of rock & sandy zones, ve. wet sample, medium
48.01	49.5'	SS32		3-4-5	1.5'	Brown sandy rocky clay, very moist, medium
49.5'	Total (depth				
						,
						•
						•
'MARKS: (Casing, Water	Loss, Etc	:.)			Water Level Time Date (Completion
<u> </u>						

Layne-Western Company, Inc.

CONSTRUCTION OF WELL



	L	te Ci	+- 445		JI BUN	Boring No KW 5-1 Sheet 1 of 1
Project	<u> </u>					Surface Elevation 751.7 Offset
Ad						Date Started 8/10/81 Completed 8/10/81
L State	Indep	endenc	e, Mis	souri		Driller T. Butler Rig
				Abt	previetions:	
DE	DEPTH		PENETRA	TION RECORD	≿	SAMPLE DESCRIPTION •
FROM	то	МЕТНОБ	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.01	1.0'	WB		·		Topsoil
1.0'	5.5'	WB				Light brown silty clay, med.
5.5'	9.5'	WB				Gray silty clay, med.
9.5'	11.0'	ST1	2.0			Gray silty clay w/trace sand, stiff
11.0'	15.0'	₩B				Gray silty clay w/trace sand, med.
15.0'	19.5'	WB				Light brown silty clay w/trace sand
.g.5'	21.0'	ST2	2.5			Light brown & gray silty clay, very st
21.0'	23.5'	WB				Light gray sandy clay, med.
23.5'	29.5'	WB				Light gray sandy clay, soft to med.
29.5'	34.0'	WB				Light gray sandy clay, med. to stiff
34.0'	40.0'	WB				Light gray sandy clay, soft to med.
40.0'	Total	depth				•
						•
MARKS:	(Casing, Wate	r Loss, Etc	:.)			Static Water Level Time Date
mped	1 hour	- 2 G	PM			12.8 9/11/81 _(Completion)
				 	<u>.</u>	
gyne -U	Vestern	Comp	pany,	Inc.	C-2	12

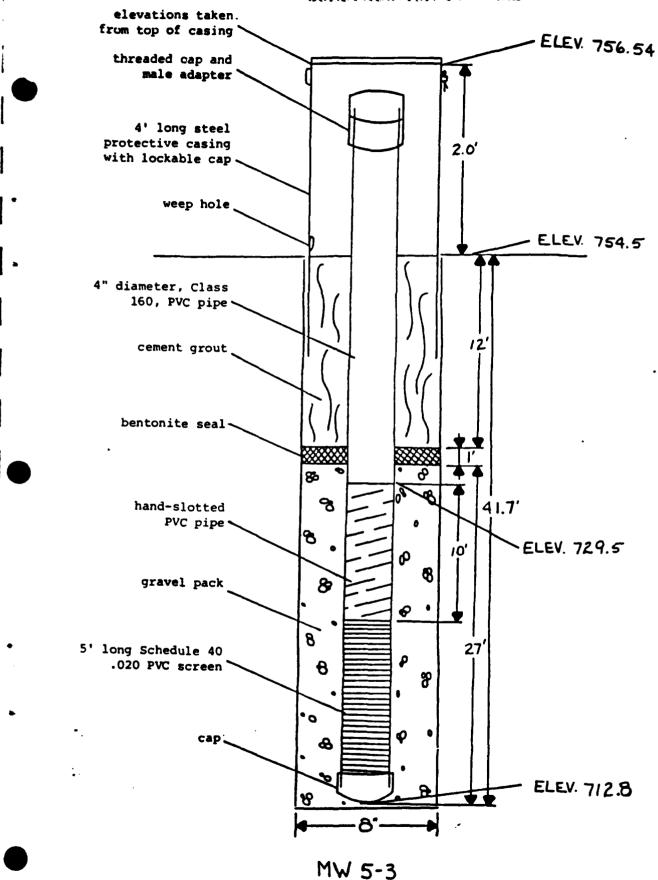


MW 5-2

C-213 RESERVE OF 1/85

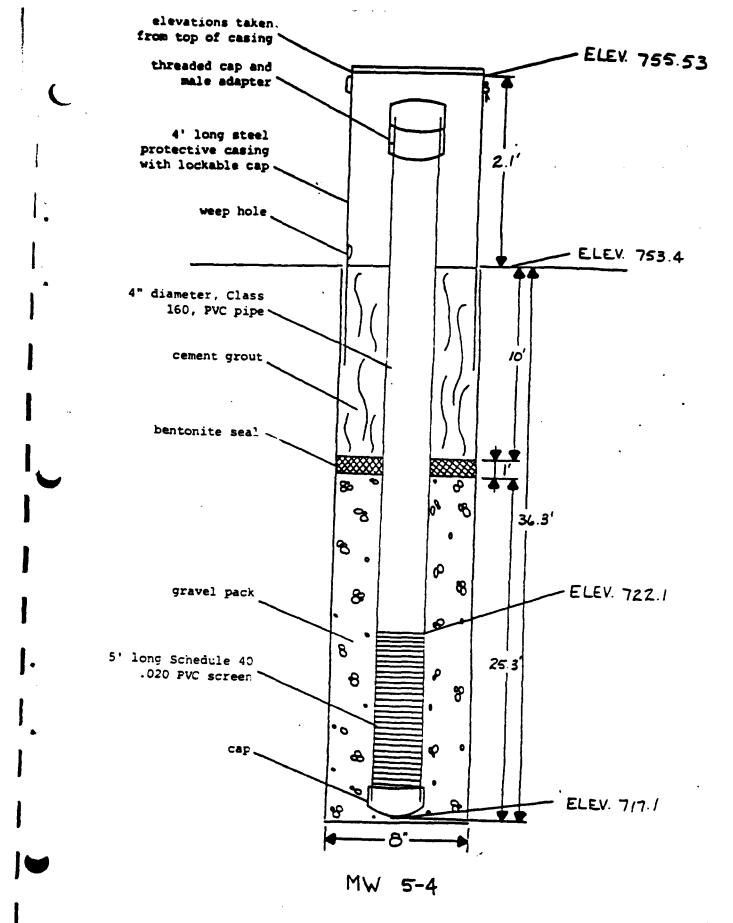
²roject	Lake C	Lty AA	P			Boring No. <u>MW 5-2</u> Sheet 1 of 1
J						Surface Elevation 753.6 Offset
+0						Date Started 7/28/81 Completed 7/28/81
Lity & State	Indep	enden	ce, M	issouri		Driller T. Butler Rig
1					previetions:	
DE	тн		PENETR	ATION RECORD	~	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NO OF	CORE RECOVE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.3'	WB				Topsoil
1.3'	5.0'	WB				Brown & gray silty clay, stiff
5.0'	6.41	WB				Dark brown silty clay, soft
6.4'	10.0'	WB				Brown silty clay, stiff
10.0'	20.0'	WB				Gray brown silty clay, stiff
.0'	24.5'	WB				Gray brown silty clay, soft
5'	27.5'	WB				Gray brown silty clay, stiff
27.5'	29.5	WB				Tan & green weathered shale, med.
29.5'	31.0'	WB				Same
31.0'	34.0'	WB				Same
34.0'	35.0'	MB				Weathered shale & gray shale, hard
35.0'	40.0'	WB				Gray shale, hard
40.0'	Total	depth				
•	Casing, Water					Static Water Level Time Date
Pumped	1-1/2 b	our -	1/2	ЗР И		13.6 9/11/8 (Completion)

yne-Western Company, Inc.

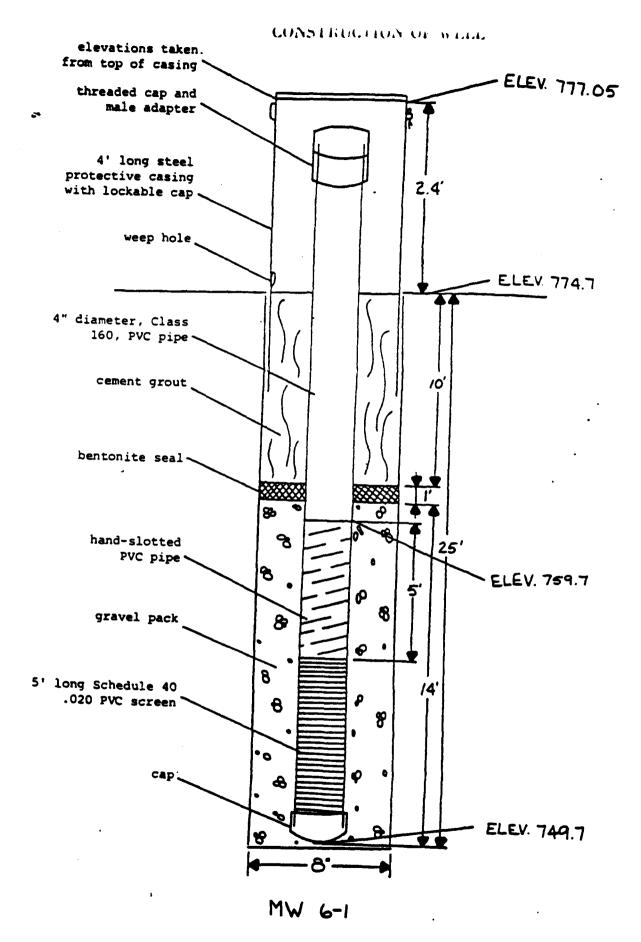


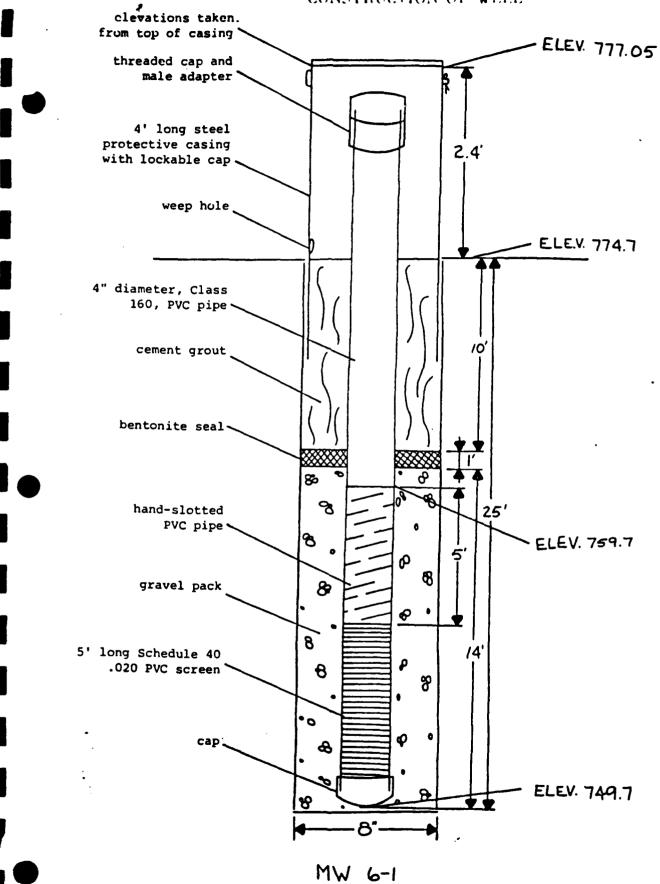
C-215 Reservement 4/05

roject	Lake	City A	AP		·	Boring No. WW 5-3 Sheet 1 of 1
						Surface Elevation 754.5 Offset
		•				Date Started 8/10/81 Completed 8/11/81
ty & State_	Inde	penden	ce, Mi	ssouri		Driller B. Blank Rig
j				Abi	brevietions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Weser H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECORD	H Y	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO. METER	NO. OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB				Gray brown silty clay, stiff
5.0'	10.0'	WB				Same
10.0'	15.0'	WB				Same .
15.0'	16.5	ST1	1.75	.,		Same
19.51	20.0'	WB				Same
0'	25.0'	WB				Same
25.0'	30.0'	WB				Same
30.0'	35.0'	WB		•		Same
35.0'	35.5'	WB				Gray brown silty clay w/trace sand, stiff
35.5'	40.0'	WB				Yellow brown sandy clay w/trace grave med.
40.0'	Total	depth				
MARKS: (Casing, Wate	r Loss, Etc	<u></u>)			Static Water Level Time Date
. umped	2 hours	- 1/	2 GPM			
vina-II	lestern	Com			C-2	16



1				TES	ST BOR	ING LOG
Project	Lake C11	y AAP				Boring No. WW 5-4 Sheet 1 of 1
1 _	··					Surface Elevation 753.4 Offset
Adu.						Date Started 7/28/81 Completed 7/28/81
& Stone	Inder	enden	ce, Mi	Lssouri		Driller J. Von Holt Rig
1				Abbr	revietions:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit S.S. — Split Spoon C.A. — Core Air F.B. — Finger Bit
DE	PTH	1		ATION RECORD	₽	SAMPLE DESCRIPTION
FROM	то	МЕТНОО	POCKET PENETRO- METER	NO. OF	CORE RECOVE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.01	WB				Topsoil
1.0'	6.0'	WB				Brown silty clay, stiff
6.0'	23.01	WB				Brown & gray silty clay, stiff
23.0'	31.0'	WB				Gray w/trace brown silty clay, stiff
31.0'	38.0'	WB				Yellow brown & gray shaley clay w/trac sand & gravel, stiff
38.0'	40.5'	WB				Yellow brown shaley clay, stiff
411.81	42.0'	SS1	1.5			Same
12.0'	Total	depth				
						
1_					.	
•						
J						
MARKS:	(Casing, Wate	r Loss, Etc	:.)			Static Water Level Time Date
						7.4 9/11/81 (Completion)
Eine-U	Vestern	Com	pany,	Inc.	C-21	,



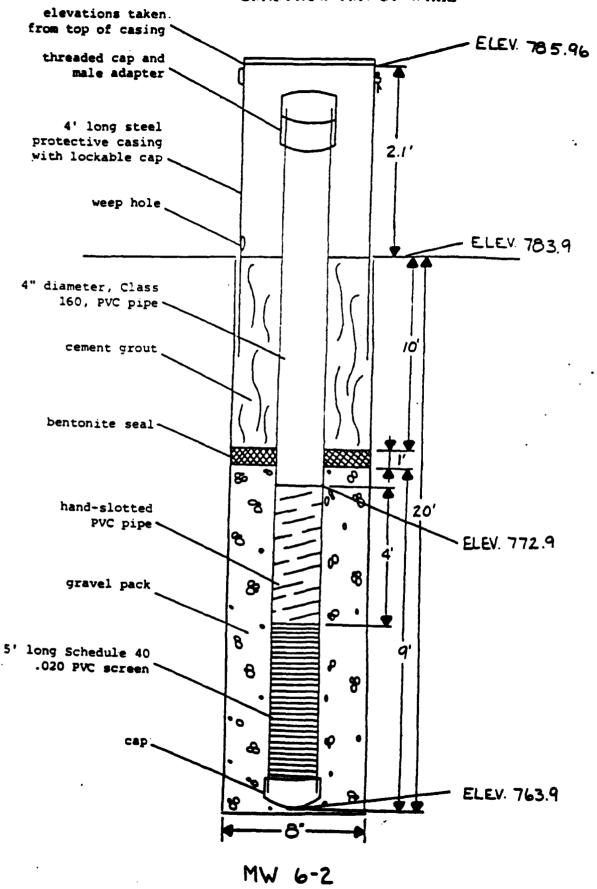


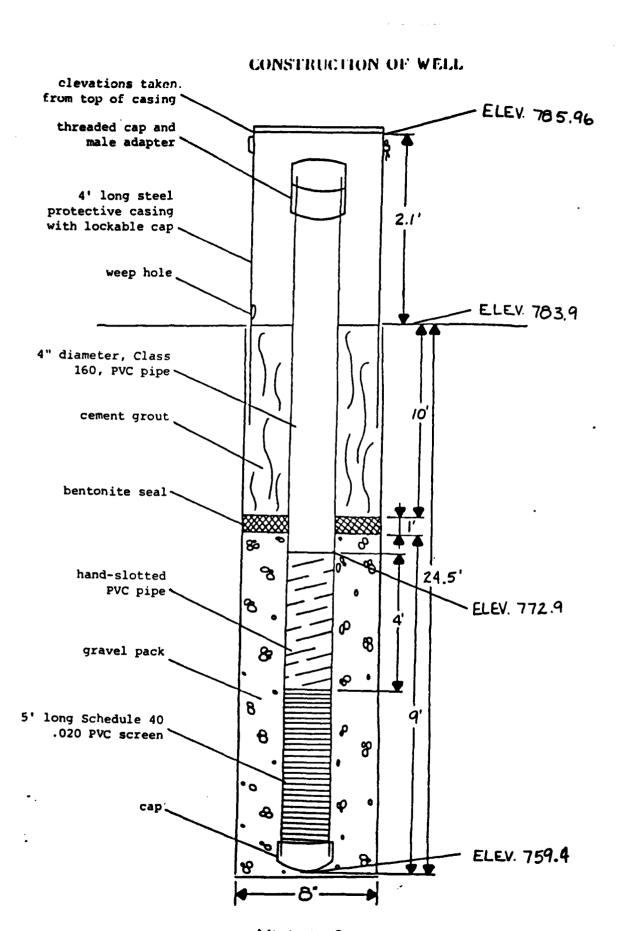
C-220 REDEVELOPMENT E/85

TEST	BO	RIN	G	LOG
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ect	Lake C	ity AA	P			Boring No
						Surface Elevation 7.74.7 Offset
, we						Date Started 8/5/81 Completed 8/5/81
& State	Indepe	ndence	, Mis	souri		Driller D. Yogt Rig
_					bbreviations:	A.O. — Auger Only R.B. — Rock Bit .W. — Core Weter H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
• DE	PTH		PENETRA	TION RECOR	ב פ	SAMPLE DESCRIPTION
ROM	то	МЕТНОВ	POCKET PENETRO. METER	NO. OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
.0'	1.5'	₩B				Topsoil
5 '	7.0'	WB				Dark brown silty clay, stiff
7.0'	10.0'	WB				Gray brown silty clay, stiff
10.0'	11.5'	WB				Same
11.5'	20.0'	WB				Same
30 ,	22.3'	WB				Weathered limestone lenses & gray shall
22.	32.0'	WB				Gray shale, med.
32.0'	40.0'	₩B				Maroon shale, hard
10.0'	Total	depth				
4						
•						
-		-				
		-				
## S:	(Casing Wate	r Loss, Et	<u> </u> c.)			Static Water Level Time Date
	d 1-1/2			М		7.5 9/10/81 (Completion

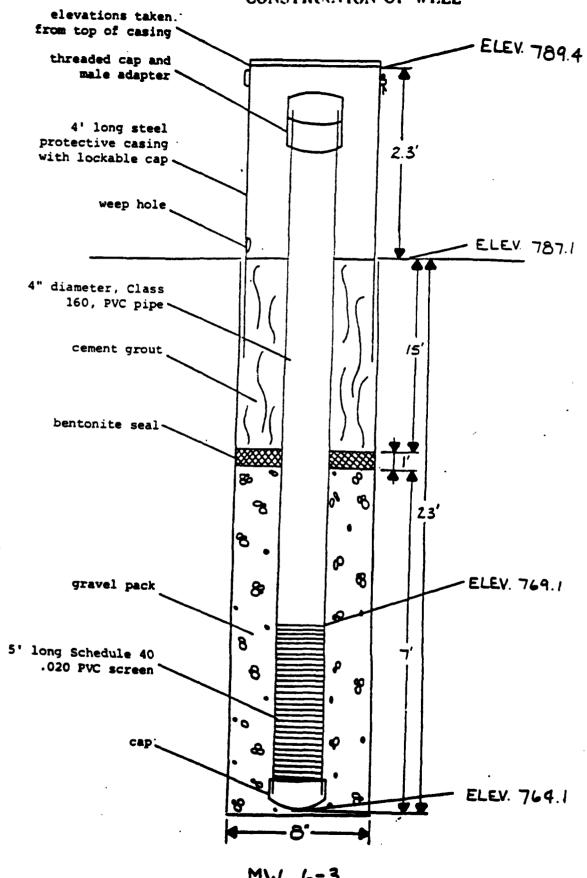
CONSTRUCTION OF WELL



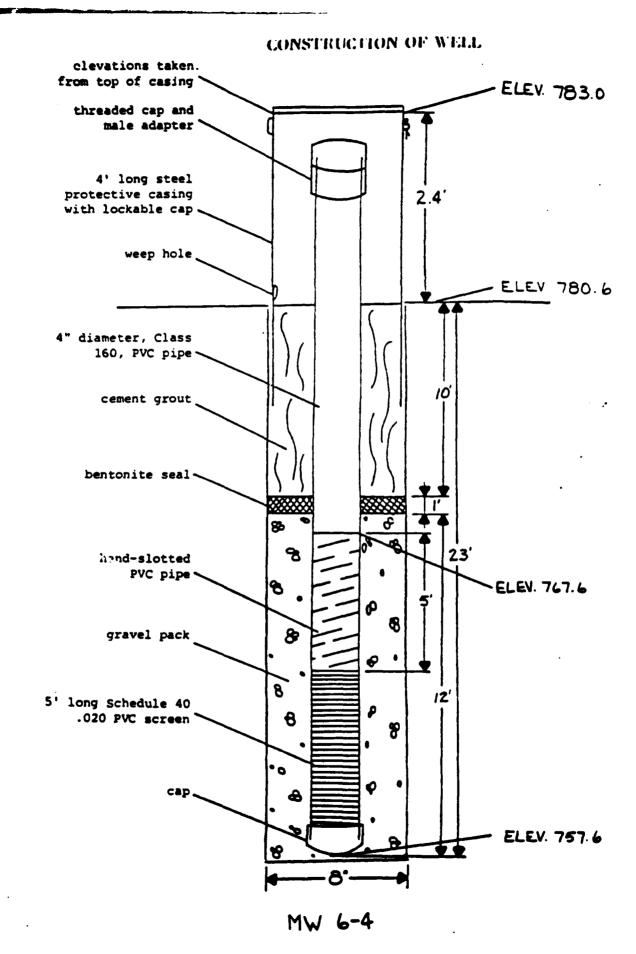


B oject	Lake C	ity AA	P			Boring No. MW 6-2 Sheet 1 of
	<i></i>	,				Surface Elevation 783.9 Offset
idrees						Date Started 8/6/81 Completed 8/6/81
L State_	Inde	epende	nce, M	lissouri		Driller D. Vogt Rig
ĺ				Abb	reviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Rock Bit C.W. — Core Wat C.A. — Core Air S.S. — Solit Spoon C.A. — Core Air F.B. — Finger Bi
DEPTH PENETRATIO		TION RECORD	<u></u>	SAMPLE DESCRIPTION		
FROM	το	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY L
0.0'	1.0'	WB				Topsoil
1.0'	6.0'	WB				Dark brown silty clay, soft
6.0'	11.0'	WB				Brown silty clay, stiff
11.0'	17.0'	WB				Olive brown weathered shale, soft to
17.0'	27.0'	WB				Gray shale, med.
27.0'	28.0'	WB				Weathered limestone lenses & gray sh
28.0'	40.0'	WB				Gray shale, hard
0.01	Total	depth				
 						
-						
						•
-						•
	Casing, Water					Static Water Level Time Date
Pumped	1-1/2	our -	1-1/2	GPM		4,2 9/10/81 _(Completi)

CONSTRUCTION OF WELL

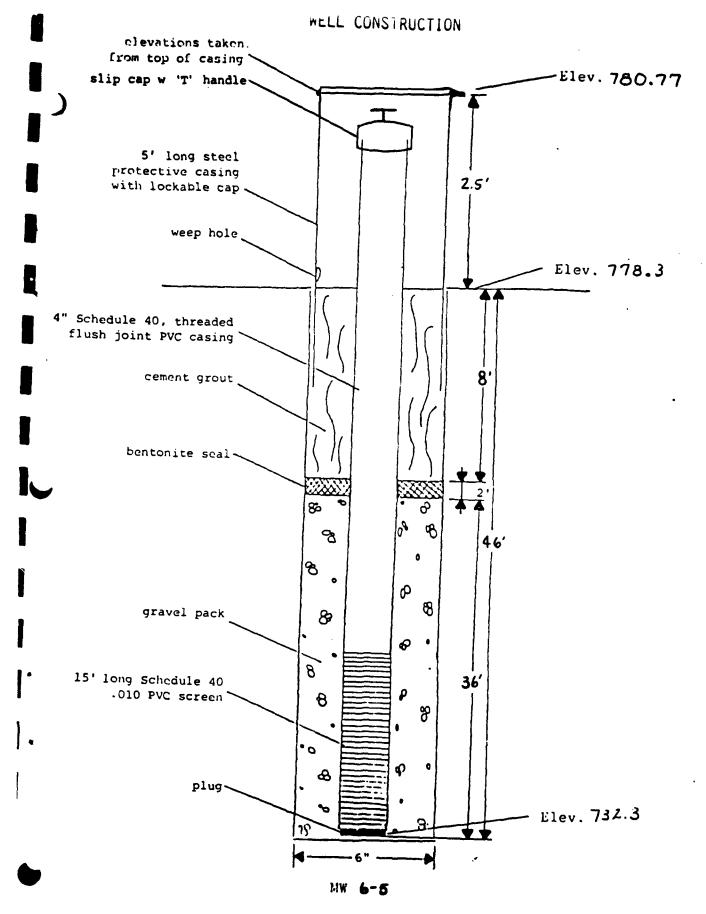


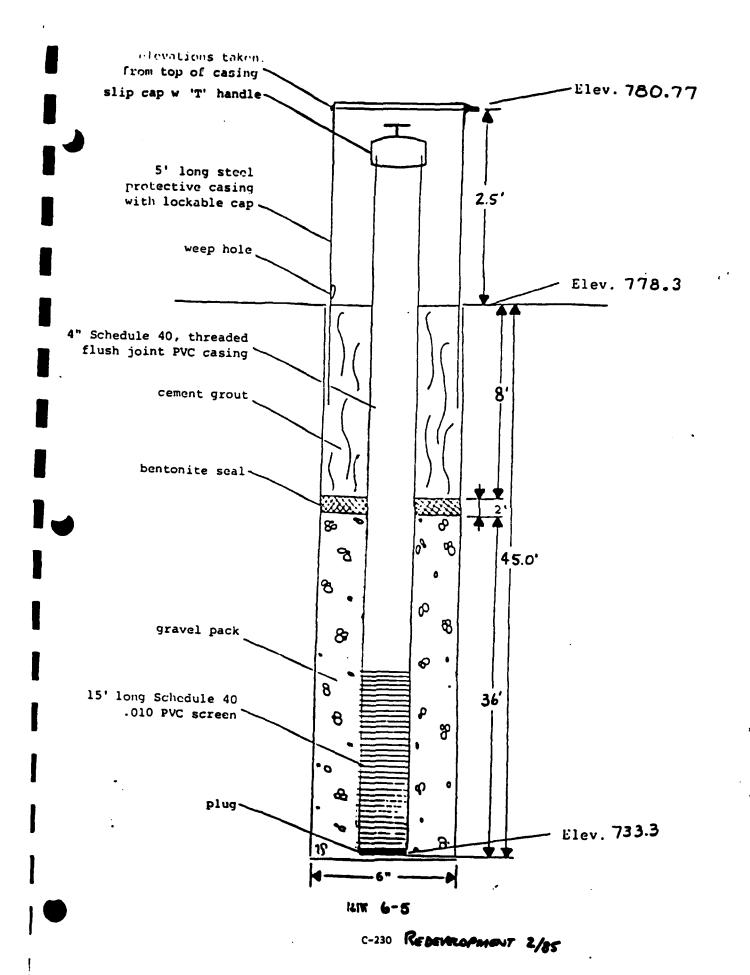
				TE	ST BOR	ING LOG		
roject	Lake	City	AAP			Boring No Sheet _ 1 of _ 1		
						Surface Elevation 787.1 Offset		
ddress						Date Started 8/6/81 Completed 8/6/81		
ny & State_	Indep	enden	ce, Mi	ssouri		Driller T. Butler Rig		
	•				revistions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit *		
OE	PTH			PENETRATION RECORD		SAMPLE DESCRIPTION		
FROM	ROM TO GOT		POCKET PENETRO- METER NO OF BLOWS		CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY		
0.01	0.5'	WB			····	Topsoil		
0.5'	4.0'	WB				Dark brown silty clay, med. to stiff		
4.0'	9.0'	WB				Light brown silty clay, med. to stiff		
9.01	10.5	STI	3.5			Light brown silty clay, very stiff		
10.5'	13.5'	MB				Tan silty clay w/trace weathered shale stiff		
.5'	19.0'	MB				Light tan shaly clay, stiff		
19.0'	20.01	ST2	4.5			Light tan & gray shaly clay, very stif		
20.0'	22.5'	WB				Light gray shale, med. to hard		
22.5'	27.5'	WB				Same		
27.5'	28.01	WB				Dark gray sandy shale, med. to hard		
28.0'	30.0'	WB			<u>- </u>	Light gray shale, med. to hard		
30.0'	31.0'	WB				Same .		
31.0'	33.5'	WB				Dark gray sandy shale, med. to hard		
33.5'	40.0'	WB				Light gray shale, med. to hard .		
40.01	Total	depth						
		·			<u></u>			
ARKS:	Casing, Water	r Loss, Ew	L)		Static Water Level Time Date			
Saped.	1 hour	- 1-1	/2 GPM			1.5 9/10/81 (Completion)		
	•							



LOG PONING LOG

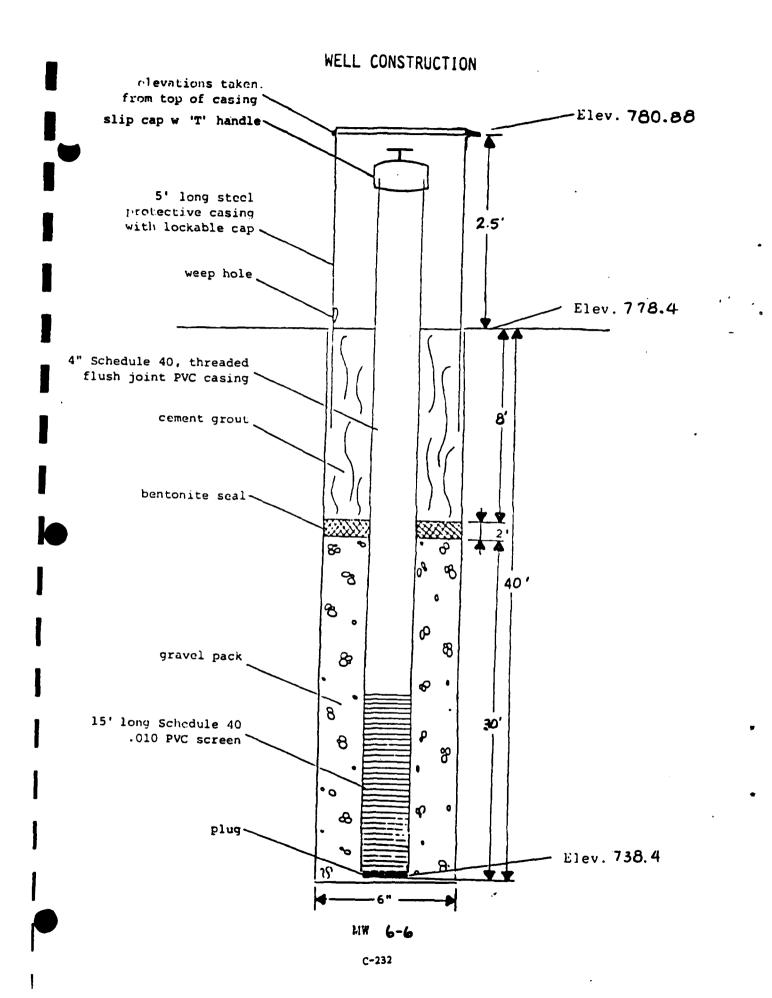
ject Lake City AAP						Boring No. MW 6-4 Sheet 1 of 1		
						Surface Elevation 780.6 Offset		
						Date Started 8/13/81 Completed 8/13/81		
A State Independence, Missouri						Driller Rig		
			•	Abi	breviations:			
DE	РТН		PENETRA	TION RECORD	>	SAMPLE DESCRIPTION		
ROM	то	МЕТНОВ	PUCKET PENETRO METER	NO. OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY		
.0'	0.9'	WB				Topsoil		
.9'	3.5'	WB				Brown silty clay, med.		
. 5 '	7.0'	WB			!	Dark gray silty clay, med.		
.0'	9.5'	WB				Light brown silty clay, med. to stiff		
. 5 '	11.0'	ST1	4.5			Light brown silty clay, very stiff		
1.0'	12.5	WB				Same		
	15.5'	₩B				Light tan shaly clay, stiff		
5.5'	16.0'	WB				Weathered shale, hard		
6.0'	21.5'	WB				Light tan shaly clay, med. to stiff		
1.5'	23.0'	WB				Light gray shale, med. to hard		
3.0'	25.0'	WB				Dark gray shale, med. to hard		
5.0'	40.0'	WB				Light gray shale, med. to stiff		
0.0'	Total	depth						
ARKS: (Casing, Water Loss, Etc.)						Static Water Level Time Date		
	1-1/2 1			GPM	3.7 9/10/81 Completio			
		7 40 _	<u>/-</u>			(Completto		
	bstern	_						

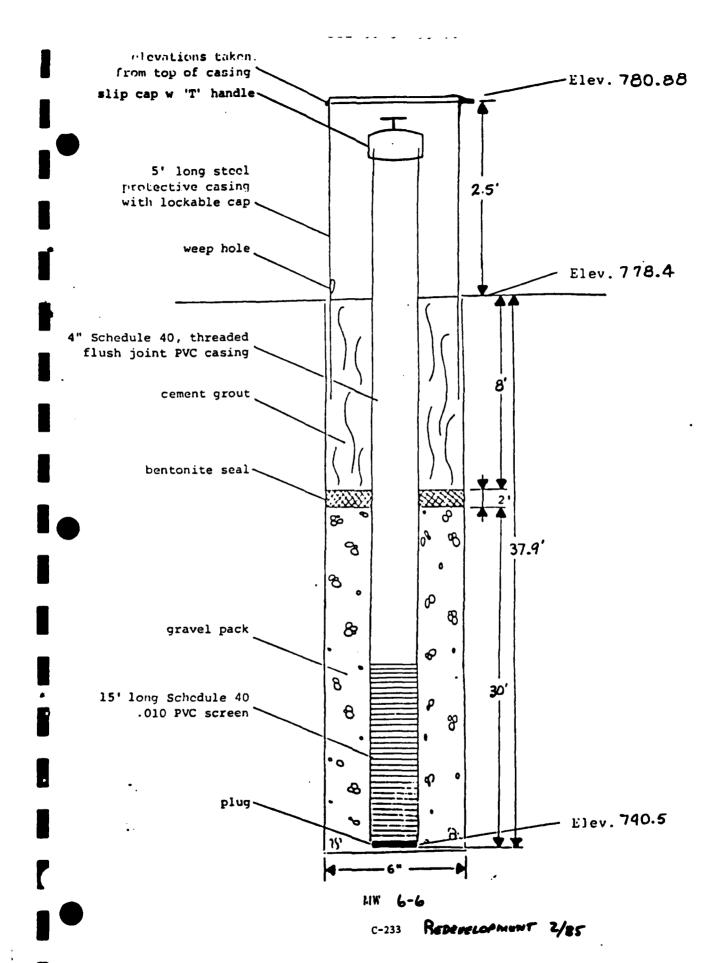




ojectL	ake City	Army A	mmunitio	on Plant		Boring No		
_						Surface Elevation 778.3 Offset		
iloress					Date Started 1/5/83 Completed 1/5/83			
ty & State_	Indepe	ndence	, Missou	ri		Driller R. Kelly Rig CME-55		
				Abi	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit S.S. — Split Spoon C.A. — Core Water C.W. — Core Water C.A. — Core Air F.B. — Finger Bit		
• DE	PTH		PENETRA	TION RECORD	ERY	SAMPLE DESCRIPTION		
FROM	то от		POCKET PENETRO. METER NO. OF BLOWS		CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY		
0.0'	0.6'	на				Topsoil		
0.6'	5.5'	на				Dark brown silty clay, moist, very stiff		
5.5'	8.7'	НА				Brown silty clay, moist, very stiff		
8.7'	9.2'	на				Yellow brown shaly clay, moist, very stiff		
9.2'	13.0'	на				Yellow brown clayey shale, moist, very stiff		
0,	18.0'	на				Olive brown shale, dry, med. to hard		
.0'	23.0'	НА				Yellow weathered shaly sandstone, dry, med. to hard		
23.0'	25.5'	на				Yellow brown weathered shale, dry, med. to ha		
25.5'	31.0'	на		:		Gray shale, dry, med. to hard		
31.0'	40.0'	на				Gray clayey shale, moist, soft to med.		
10.0'	46.0'	на				Gray clayey shale, very moist, soft		
46.0'	Total d	lepth						
	 							
ARKS: (Casing, Water	Loss, Et	c.)			Water Level Time Date		
	<u>-</u>					28.2 4:00pm 1/5/83 (Completion)		
						18.2 3:30pm 1/6/83		

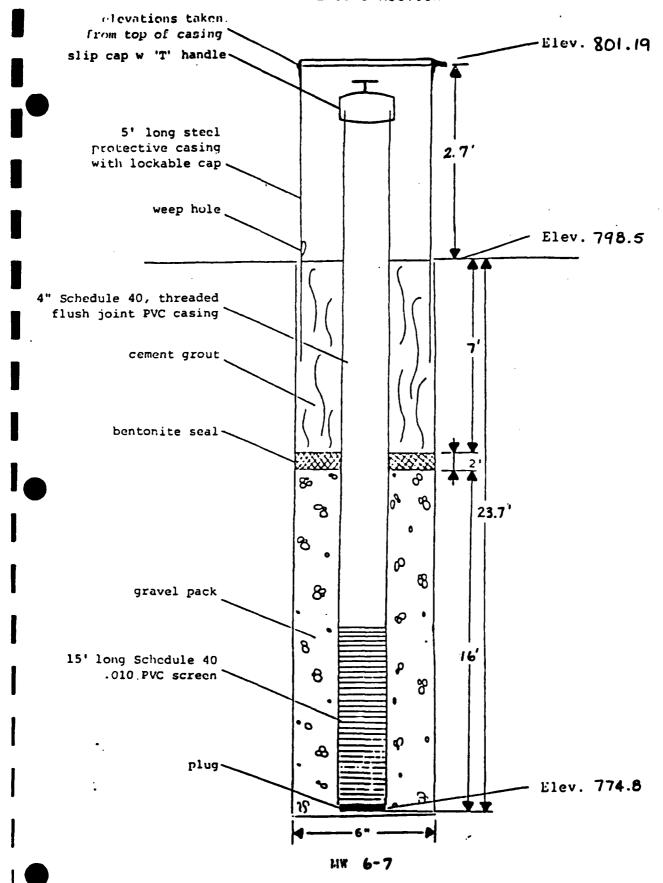
Layne-Western Company, Inc. c-231





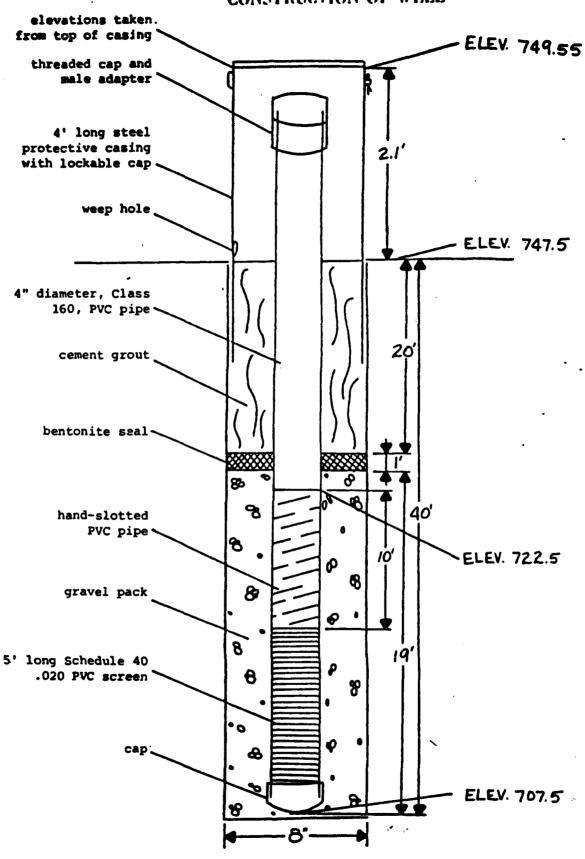
ojectLa	ke City	Army A	mmunitio	n Plant	Boring No. <u>MW 6-6</u> Sheet 1 of 1	
		•			·	Surface Elevation 778.4 Offset
d olls						Date Started 1/7/83 Completed 1/7/83
ity & State Independence, Missouri						Driller R. Kelly Rig CME-55
					breviations:	A.O Auger Only R.B Rock Bit C.W Core Water H.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wash Bore S.T Shelby Tube F.B Finger Bit -
DEP	тн		PENETRA	TION RECORD	*	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	0.6'	на				Topsoil
0.6'	6.31	на				Dark brown silty clay, moist, stiff
6.3'	13.5'	на		· · · · · · · · · · · · · · · · · · ·		Light brown silty clay, moist, very stiff
13.5'	22.5'	на		**···		Brown gray shaly sandstone, slightly moist, med. to hard
22.5'	29.0'	на				Gray shale, slightly moist, med. to hard
.9.01	30.0'	на				Gray shale, moist, med. to soft
9 .0'	35.01	на				Gray shale, very moist, soft to very soft
35.0'	36.5'	ST1			0.0'	Same
36.5'	40.0'	НА		-		Gray shale, moist, soft
40.0'	41.5'	STl	1.75		1.3'	Gray shale, moist, soft to med.
41.5'	Total	depth				
			-			•
						7
			-			•
AARKS: ((Casing, Wate	r Loss. Fi	tc.)		Water Level Time Date	
		, _			20.0 4:00pm 1/7/83 (Completion	
						Completion

MW 6-7



C-236 Redevelopment 2/85

Project <u>Lal</u>	ke City A	rmy An	munition	Plant	Boring No. <u>MW 6-7</u>	Sheet 1 of 1			
		•			Surface Elevation 798.5 Offset				
Address					Date Started 1/6/83 Com	pleted <u>1/6/83</u>			
City & State	Inde	penden	ce, Miss	ouri		Driller R. Kelly	Rig <u>CME-55</u>		
				· Abt	previations:	A.O Auger Only H.A Hollow Auger W.B Wesh Bore R.B Rock S.S Split: S.T Shelb	Spoon C.A Core Air		
• DEF	РТН]	PENETRA	TION RECORD	`	SAMPLE DESCI	RIPTION		
FROM	WELTHOD OT MOS		POCKET PENETRO. METER NO. OF BLOWS		CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY			
0.0'	0.6'	на				Topsoil			
0.6'	5.0'	на				Dark brown silty day, moi	st, very stiff		
5.0'	6.51	ST1	2.5		1.5'	Same			
6.5'	11.5'	АН				Brown silty clay, moist,	stiff		
11.5'	15.0'	на				Same			
'5.0'	16.5'	ST2	1.75	_	1.5'	Yellow brown silty clay,	moist, stiff		
16.5'	25.0'	НА				Same			
25.0'	Total	depth							
		ļ							
	· · · · · ·								
	,								
									
'AARKS: (Casing, Wate	r Loss, E	tc.)		Water Level Time	Date			
•						5.0 12:00p	m 1/6/83 (Completion		
						3.0 3:30p	m 1/6/83		



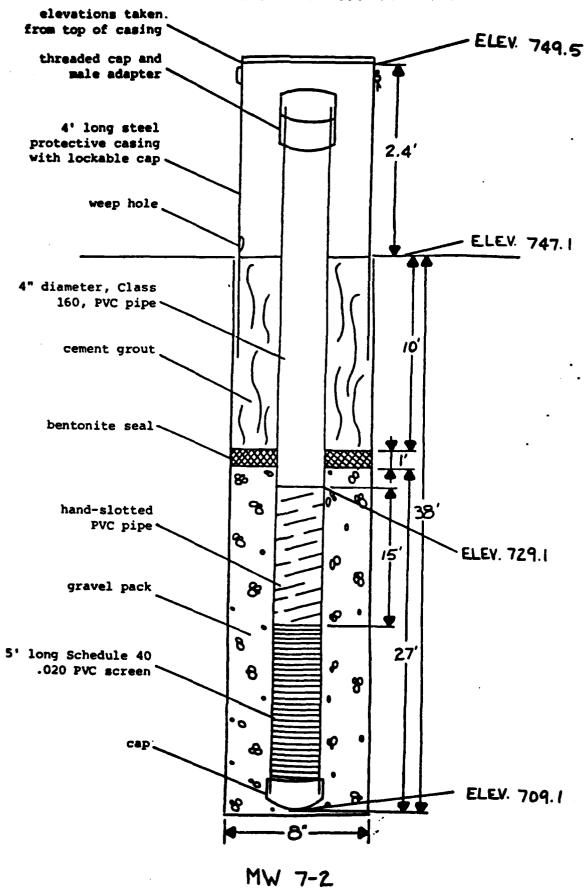
MW 7-1

Toject	Lake Cit	Ly AAP			 ,	Boring No. MW 7-1 Sheet bf 1			
]						Surface Elevation 747.5 Offset			
799 						Date Started 8/4/81 Completed 8/4/81			
ty & State_	Indep	enden	ce, Mi	ssouri		Driller T. Butler Rig			
]				Abb	reviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit			
• DE	PTH	PENETRATION RECORD		<u>*</u>	SAMPLE DESCRIPTION				
FROM TO		METHOD	POCKET PENETRO METER NO OF BLOWS		CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY			
0.0'	2.5'	WB				Topsoil			
2.5'	4.0'	WB				Dark brown silty clay, med. to stiff			
4.0'	9.0'	WB				Dark gray & brown silty clay, med. to stiff			
9.0'	10.5'	ST1	2.5			Dark gray silty clay w/trace sand, med. to stiff			
10.5'	15.0'	WB				Dark gray silty clay w/trace sand, sof to med.			
.0'	17.5'	WB				Dark gray silty clay, soft to med.			
5 '	19.0'	WB				Dark gray silty clay w/trace sand, sof to med.			
19.0'	20.5'	WB				Dark gray silty clay, med. to stiff			
20.5'	24.0'	WB				Gray silty clay, med. to stiff			
24.0'	29.0'	WB				Same			
29.0'	31.5'	ST2	4.5		_	Same			
31.5'	34.5'	WB				Gray silty clay, soft to med.			
34.5'	40.0'	WB				Gray fine sand			
40.0'	Total	depth							
ABVC.	(Casino Water		. 1			Static Water Level Time Date			

Pumped 1-1/2 hour - 2 GPM

26.6

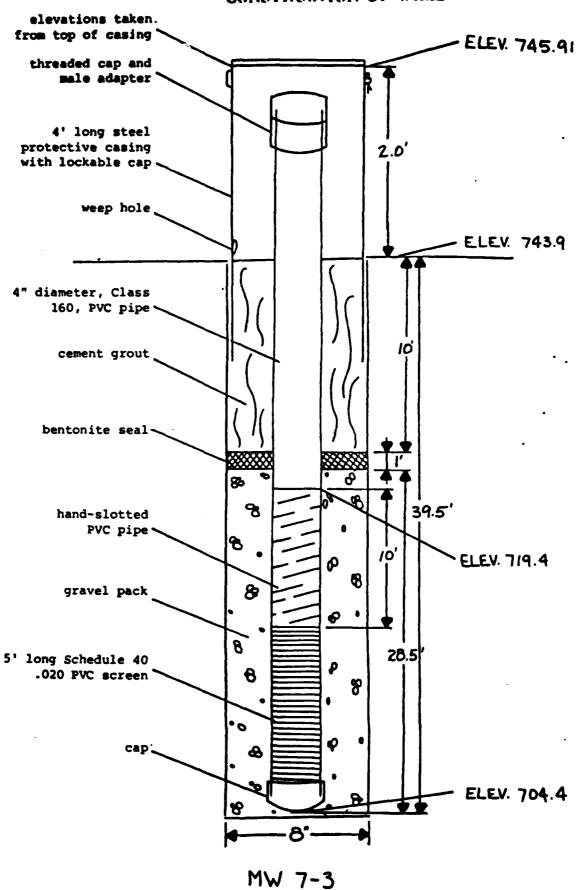
9/11/81_(Completion)



C-240

roject La	ke City	AAP				Boring No. <u>MW 7-2</u> Sheet <u>1</u> of <u>1</u>
Ad Car					<u> </u>	Surface Elevation 747.1 Offset Date Started 7/31/81 Completed 7/31/81
ty & State_	Inde	penden	ce, Mi	ssouri		Driller J. Von Holt Rig
1				Abi	breviations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit C.W. — Core Water C.A. — Core Air S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH		PENETRA	TION RECORD	_ ≥	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	WB				Topsoil
1.0'	7.0'	WB				Brown silty clay, stiff
7.0'	12.0'	WB				Dark gray silty clay, stiff
12.0'	18.0'	WB				Light gray & light brown silty clay
18.0'	27.0'	WB				Brown fine sand
27.0'	35.01	WB				Brown & gray fine sand
0.01	45.0'	WB				Gray fine sand
45.0'	Total	depth	-			
}						
<u> </u>						
•				· · · · · · · · · · · · · · · · · · ·		
 		 				
•				<u></u>		
		-				
Ar''ARKS: (Casing, Wate	er Loss, Etc	E.)		<u> </u>	Static WaterLevel Time Date
		····				20.9 9/11/81 (Completion
		-				
laune-U	lestern	Com	nanu	Inc	C-:	241

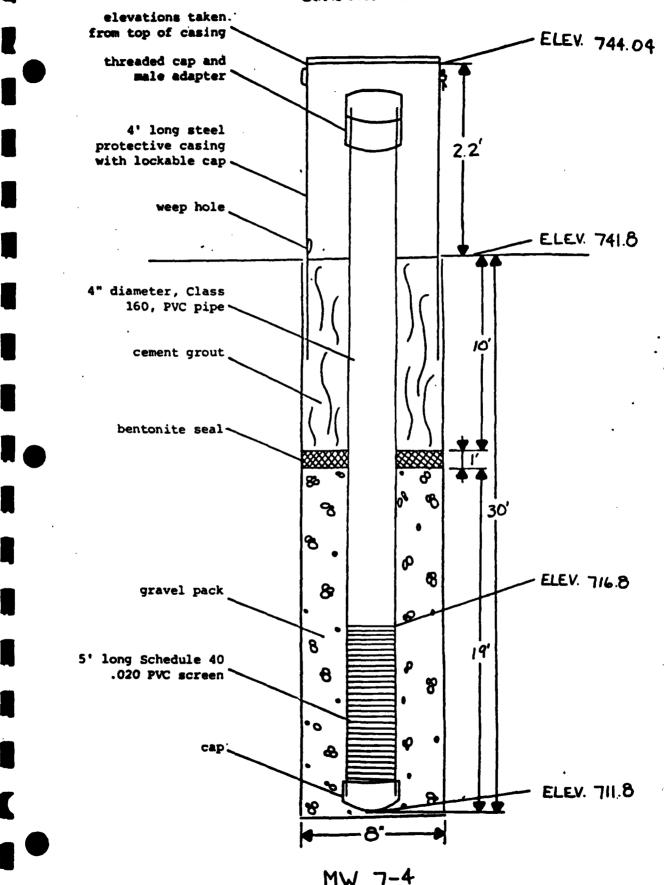
CONSTRUCTION OF WELL



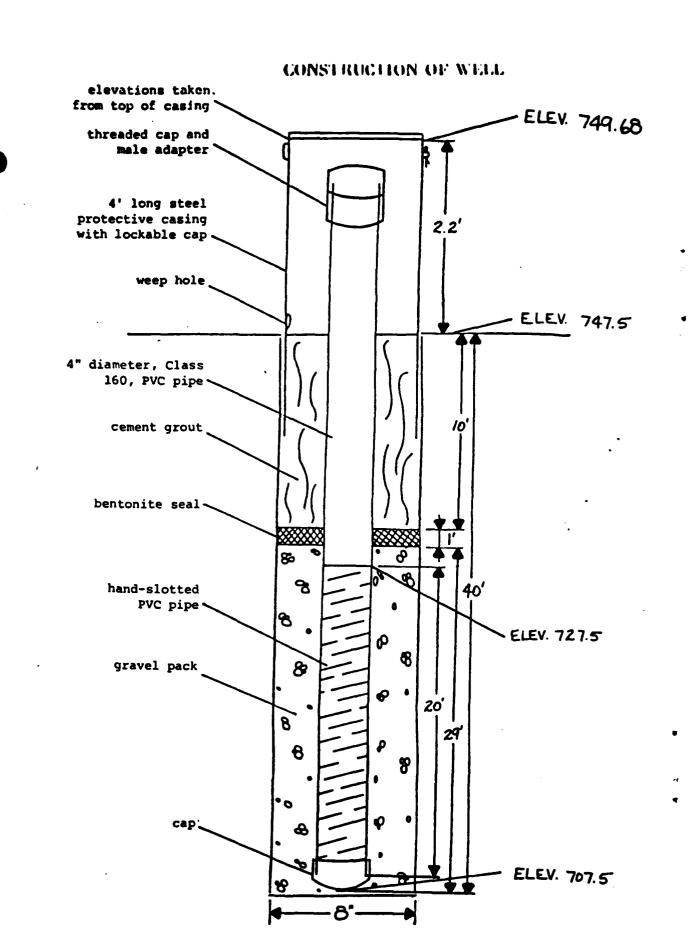
TEST	BORING	LOG
	Bar	ioo No

oj e ct	Lake	City	AAP	-		Boring No MW 7-3 Sheet1 of _ 1
·/···· }					 .	Surface Elevation 743.9 Offset
	· · · · · · · · · · · · · · · · · · ·					Date Started 8/21/81 Completed 8/21/81
y & State	Indep	enden	ce, Mi	esouri		Driller B. Blank Rig
				Abb	revietions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECORD	₩	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB				Dark gray silty clay, stiff
5.0'	9.0'	WB				Same
9.0'	10.5'	STI	1.75		· · · · ·	Same
10.5'	12.0'	WB				Same
12.0'	15.0'	WB			- 1	Gray & brown silty clay, stiff
9 .0'	19.0'	WB			 	Same
19.0'	20.5'	· ST2	1.25			Same
20.5'	23.0'	WB				Same
23.0'	25.0'	WB				Gray silty clay, stiff
25.0'	30.0'	WB				Same
30.0'	34.0'	WB				Same
34.0'	38.0'	WB				Gray very fine sand, dense
38.0'	40.01	WB				Gray silty clay w/trace sand, & coal, stiff
40.0'	Total	depth				
.MARKS:	Casing, Water	r Loss, Eu	:.)			STATIC Water Level Time Date
pped	2 hours	s, 1/2	GPM			5.6 9/11/81 _{(Completion}

CONSTRUCTION OF WELL

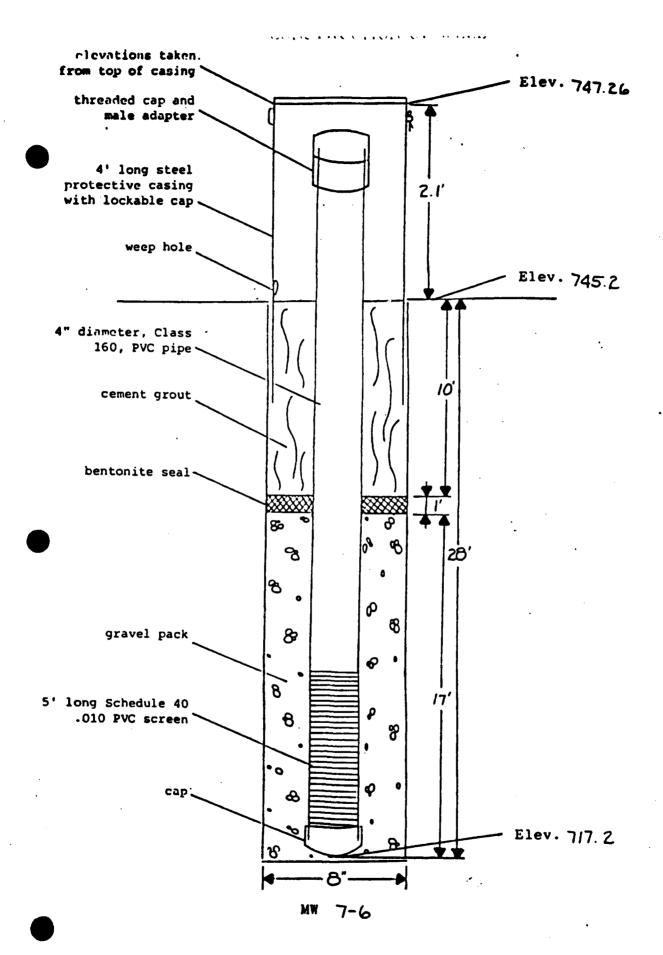


ject	Lake (City A	AP	<u> </u>	 .	Boring No NW 7-4 Sheet 1 of 1
		··				Surface Elevation 741.8 Offset
— —	· · · · · · · · · · · · · · · · · · ·					Date Started 8/3/81 Completed 8/3/81
& State_	Indep	enden	ce, Mi	ssouri		Driller T. Butler Rig
	•			Abb	reviations:	A.D. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			ATION RECORD	X	SAMPLE DESCRIPTION
FROM	то	МЕТНОО	POCKET PENETRO. METER	NO OF BLOWS	CORE RECOVER	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.5'	WB				Topsoil
1.5'	9.0'	WB				Dark gray silty clay, med. to stiff
9.0'	10.5'	SS1				Same
10.5'	13.0'	WB				Same ·
13.0'	20.0'	WB				Light gray silty clay, soft to med.
20.0'	22.0'	WB				Same
0'	25.0'	WB				Light gray silty clay w/trace sand, s to med.
25.0'	42.0'	WB				Light gray fine sand
42.0'	Total	depth				
₹			İ			
ı İ	-					
MARKS:	Casing, Wate	r Loss, Etc	:.)			Static Water Level Time Date
	d 1-1/2			PM.		20.7 9/11/81 (Completion
U						

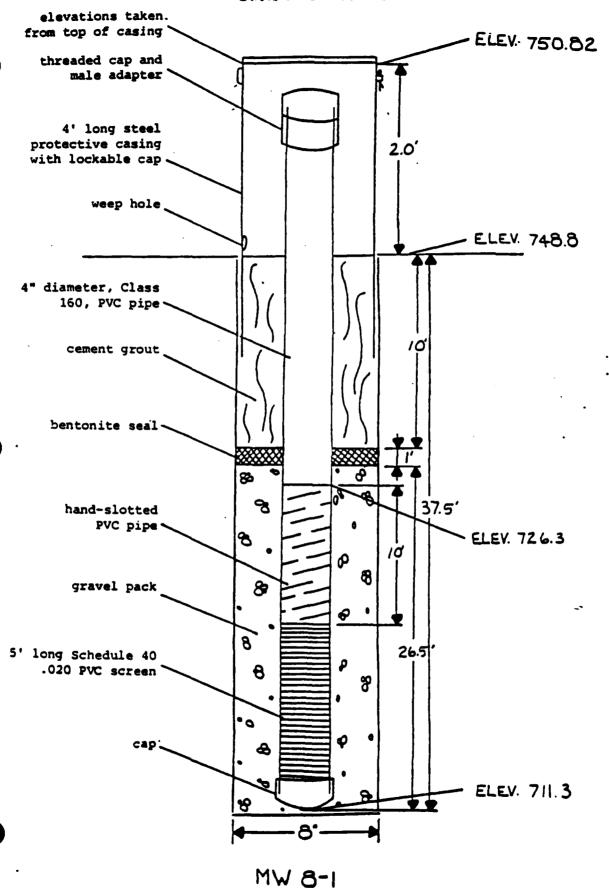


MW 7-5

ject	Lake (ity A	AP			Boring No. MW 7-5 Sheet 1 of 1				
		·				jurface Elevation 747.5 Offset				
-	_					Pate Started 9/2/81 Completed	9/3/81			
& State_	Indepe	endenc	e, Mis	souri		oriller T. Butler Rig				
	-			Abi	breviations:	.A Hollow Auger S.S Split Spoon	C.W. — Core Water C.A. — Core Air F.B. — Finger Bit			
DE	РТН		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION				
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-SAND I	CONSISTENCY DENSITY			
ō. o '	5.5'	WB				Dark gray silty clay, med.	to stiff			
5.5'	9.5'	WB				Oark gray silty clay, soft	to med.			
9.5'	11.0'	ST1	3.5			Oark gray silty clay, med.	to stiff			
11.0'	14.0'	WB				Same	. •			
14.0'	19.5'	WB				Gray silty clay w/trace samed.	nd, soft to			
5'	21.0'	ST2	1.0			Gray silty clay w/trace same	nd, soft			
** 0'	40.0'	WB				Gray fine sand				
40.0'	Total	depth								
<u> </u>	·									
•							 			
							· · · · · · · · · · · · · · · · · · ·			
•										
•										
۲۰۰ ۹KS: (Casing, Water	Loss, Etc	:.)			Static Water Lavel Time Da	te			
Pumped	2 hours	<u> </u>	GPM			,*	1/81 _{(Completion}			

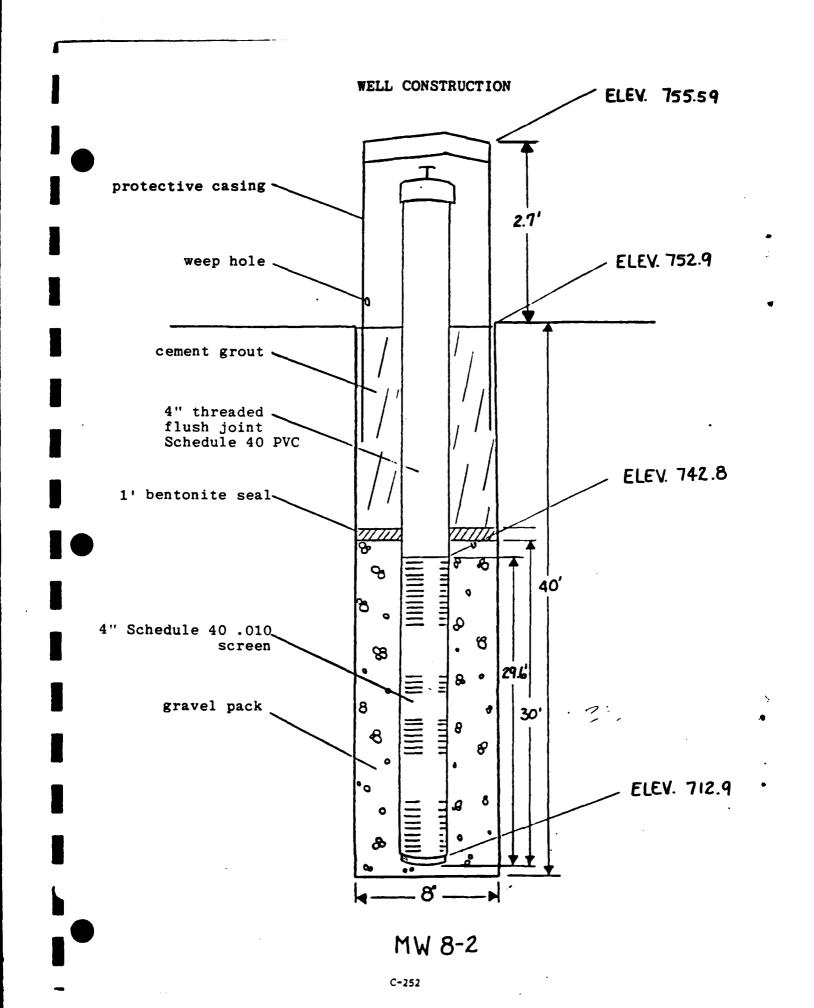


octLa	ke City A	Lemy Am	munition	Plant	 .	Boring No. MW 7-6 Sheet 1	_ Sheet 1 of 1		
						Surface Elevation Offset			
						Date Started 1/20/82 Completed 1/20/8	2		
& State_	Indeper	ndence,	Missour		·· ······	Driller T. J. Butler Rig D-2			
				Abb	reviations:	H.A Hollow Auger S.S Split Spoon C.A C.			
DE	PTH		PENETRAT	ION RECORD	≥	SAMPLE DESCRIPTION			
ROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTER	NCY		
0.0'	4.5'	WB				Dark Brown silty clay, medium to soft			
4.51	10.0'	WB				Dark gray silty clay, medium stiff			
10.0'	17.0'	WB				Same			
17.0'	24.5'	WB				Gray silty clay, medium soft			
24.5'	28.5'	WB				Light gray silty clay, medium soft	-		
5'	31.0'	WB				Maroon silty clay, w/trace sand, medium to soft	1		
31.0'	40.0'	WB				Gray fine to medium sand			
40.0'	Total De	epth			<u> </u>	ļ. :	-		
	!	-			 				
		-							
				:		<u> </u>			
			-						
 _									
							·		
BKC.	(Casing, Wate	or 1 055 E	16.1			Water Level Time Date			
	2 hours			eadily		Before 22' Pumping 1/25/82 (Co	omplet		



C-250

Proje	et	Lake	City	AAP			Boring No. <u>MW 8-1</u> Sheet 1 of
							Surface Elevation 748.8 Offset
	ess						Date Started 8/18/81 Completed 8/18/83
Sity	& State_	Inde	pende	nce,	Misśouri		Oriller B. Blank Rig
						Abbreviations:	A.O. — Auger Only R.B. — Rock Sit C.W. — Core Wa H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger E
	DE	PTH			ATION RECOF	₹ 0°	SAMPLE DESCRIPTION
	ROM	το	метнор	POCKET PENETRO. METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
• 0	0.01	1.0'	WB		,		Topsoil
1	0!	3.0'	WB				Dark brown silty clay, very stiff
3	3.0'	5.0'	WB				Brown silty clay, very stiff
5	5.0'	9.0'	WB				Same
9	9.0'	10.5'	STI	2.75			Same .
1	0.5'	12.5'	. WB				Same
	2.5	15.0'	MB				Red brown silty clay, very stiff
1	15.01	19.0'	WB				Same:
1	19.0'	20.5'	ST2	2.5			Brown silty clay w/shale & trace sandstone, very stiff
2	0.5	22.0'	WB				Same
2	22.0'	25.0'	WB				Gray silty clay, very stiff
2	25.0'	32.0'	WB				Gray fine sandy clay, very stiff
3	32.0'	37.0'	WB				Brown silty fine sand, med. dense
3	37.0'	40.0'	WB				Light brown silty clay, very stiff
4	10.0'	Total	depth				
	IA O ve				-242		Static
_	_	Casing, Water			2 GPM		Water Level , Time Date 9.9 9/14/81 (Comple
				-			
-	_						



TEST	r Bo	RI	N	GL	OG.

oject <u>L</u>	ake Cit	y A.A.	р.			Boring No.	8-2	<u> </u>		Sheet 1 of _
	eplacem	ent we	11			Surface Ele	evation	752.89	Offset	5' North of
						Date Start	od 9-25	5-84	_ Completed	9-26-84
& State	Indepe	ndence	, Mis	souri		Driller	Buck	<u> </u>	Rig _	AD-2
				Abt	previations:	A.O. – A H.A. – H W.B. – W	19guA wollo	\$.S	Rock Bit Split Spoon Shelby Tube	C.W. — Core Wa C.A. — Core Air F.B. — Finger B
DEI	РТН]	PENETRA	TION RECORD	}		S	AMPLE	DESCRIPTIO	N
FROM	то	метнор	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	co	LOR-MATE	RIAL-M	OISTURE-CLA	Y CONSISTENCY ID DENSITY
0.0	1.0	НА				Brown	silty o	lay,	moist,	very stiff
1.0	4.5	НА							ard (FI	
4.5	6.0	НА		:			rown si		clay, mo	ist,
6.0	8.5	на				very s	tiff (FILL)	clay,	
8.5	9.8	НА					rown si tiff (]		clay, mo	ist,
9.8	11.0	НА				Dark b	rown s	ilty o	clay, mo	ist, stiff
P .0	15.0	на				Gray-b	rown s	ilty o	clay, mo	ist, stiff
15.0	17.0	ST-1	2.25		1.5	Same				
17.0	18.0	HA				Same				
18.0	28.0	НА				Dark g	ray bro	own_s	ilty cla	y, moist, s
28.0	35.0	HA		·		Dark g	ray ve	y si	ty clay	, very mois
35.0	37.0	ST-2	0.75		1.0	Same				
37.0	40.0	НА				Same				
40.0	Total	Depth								
1ARKS:	(Casing, Wate	r Loss, Et	c.)		<u> </u>	<u></u> ,	WaterLevel		Time	Date
-							21.0)/26/84 (Comple
							12.8			/17/85

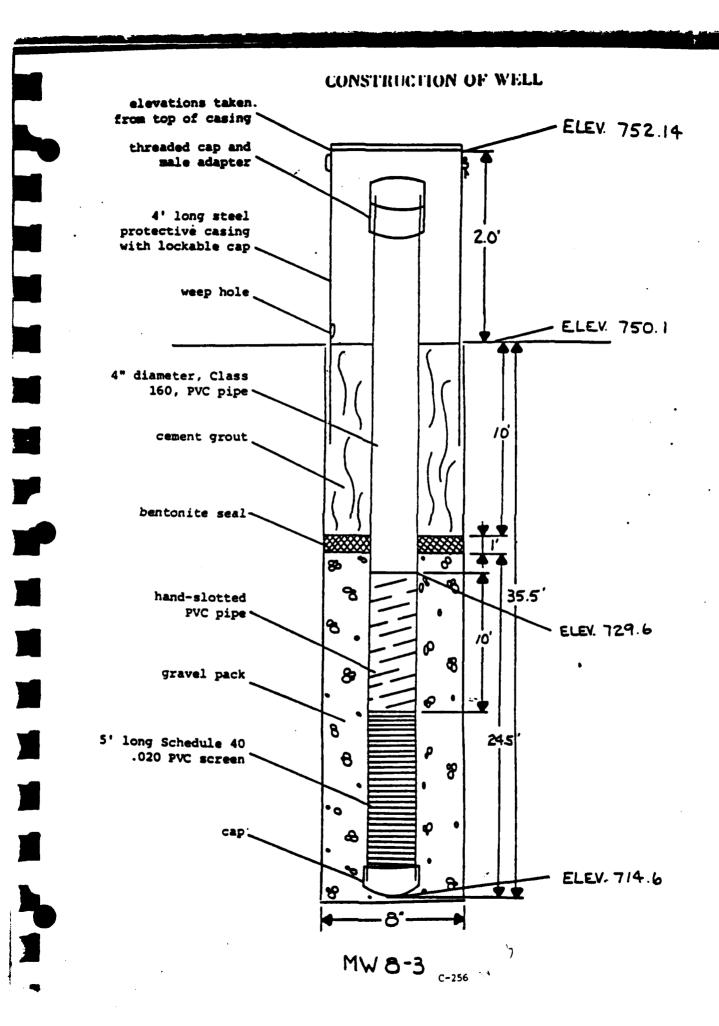
yne-Western Company,Inc.

CONSTRUCTION OF WELL elevations taken. from top of casing - ELEV. 747.79 threaded cap and male adapter 4' long steel protective casing 20 with lockable cap. . weep hole ELEV. 745.8 4" diameter, Class 160, PVC pipe cement grout 10 bentonite sealhand-slotted 38.2 PVC pipe 8 ELEV. 722.6 10' 8 gravel pack 8 P 8 5' long Schedule 40 27.2 .020 PVC screen g cap; ELEV. 707.6 MW 8-2

0-254

oject	Lake Ci	Lty AA	P			Boring No. MW 8-2 Sheet 1 of 1
Ĭ	<u> </u>					Surface Elevation 745.8 Offset
Idress						Date Started 8/19/81 Completed 8/19/81
	Indepe					Oriller B. Blank Rig
					breviations:	
DE	РТН	1		ATION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO- METER	NO. OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	WB		-	·	Topsoil
1.0'	5.0'	WB				Dark gray silty clay, very stiff
5.0'	7.0'	WB				Same
7.0'	9.0'	WB				Gray & brown silty clay, very stiff
9.0'	10.5'	ST1	2.5			Same
³ ^5'	15.0'	WB				Same
15.0'	19.0'	WB		•		Same
19.0'	20.51	ST2	2.25			Same
20.5'	23.0'	WB				Same
23.0'	25.0'	WB				Gray silty clay, very stiff
25.0'	3Q.0'	WB				Same
80.0'	32.0'	WB				Gray clayey fine sand, dense
32.0'	35.0'	WB				Gray silty clay w/trace fine sand, stiff
35 .0'	40.0'	WB		•		Same
40.0'	Total	depth				
mvaks: (Casing, Water	Loss, Etc	L)			Static Water Level Time Date
Pumped	1-1/2	our -	1-1/	2 GPM		7.4 9/14/81 Completion

yne-Western Company,Inc.



oject	Lake Ci	ty AA	P	·		Boring No. <u>MW 8-3</u> Sheet 1 of
5						Surface Elevation 750,1 Offset
ress				<u>, , , , , , , , , , , , , , , , , , , </u>		Data Started 8/20/81 Completed 8/20/81
ry & State_	Indep	enden	ce, Mi	ssouri		Driller B. Blank Rig
				Abt	previstions:	A.O. — Auger Only R.B. — Rock Bit C.W. — Care W. H.A. — Hollow Auger S.S. — Split Spoon C.A. — Care A. W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger
DE	тн			TION RECORD	. }	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO- METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	WB				Topsoil
1.0'	5.0'	WB		·		Dark brown silty clay, very stiff
5.0'	7.0'	WB				Same
7.0'	9.0'	WB				Brown & gray silty clay, stiff
9.0'	10.5'	ST1	1.25			Same
9.5'	15.0'	WB				Same
15.0'	19.0'	WB				Same
19.0'	20.5'	ST2	1.5	•		Brown & gray silty clay w/trace sha
20.5'	22.5'	WB				Same
22.5'	25.0'	WB				Waroon & olive & gray shale w/trace fine sand, very stiff
25.0'	30.0'	W B				Gray silty fine sand w/trace clay, very stiff
30.01	33.5'	WB				Gray silty fine sand, dense
33.5'	35.01	WB				Gray silty clay, very stiff
35.0'	40.01	WB				Gray silty clay w/trace lignite, ver
40.0'	Total	depth				
ARKS: I	Casing, Water	Lon Ev				Static Water Level Time Date
	2 hours					5.9 9/14/8 _{Comple}
						

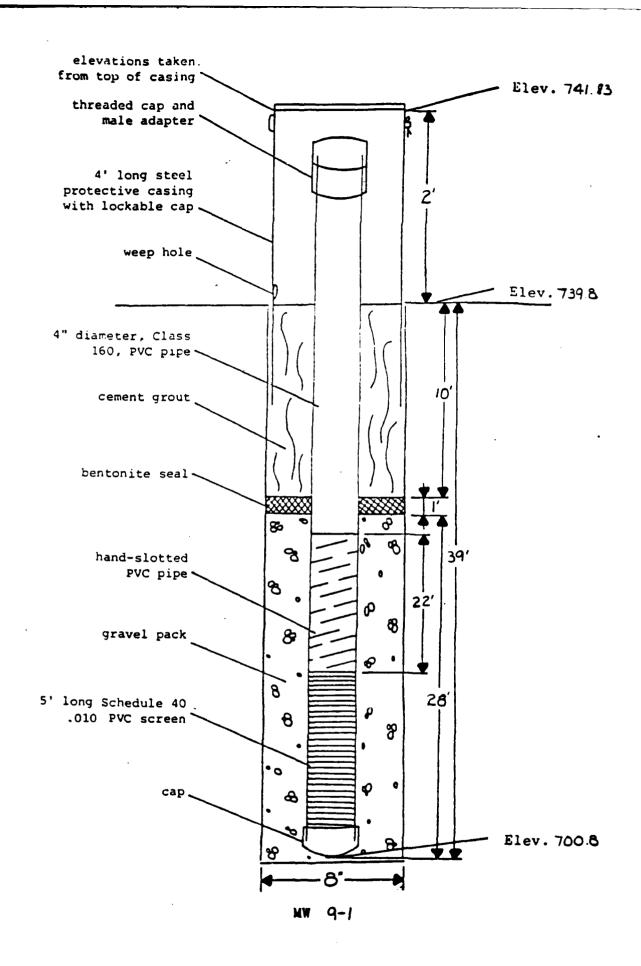
CONSTRUCTION OF WELL elevations taken. from top of casing ' - ELEV. 764.66 threaded cap and male adapter 4' long steel protective casing 2.3' with lockable cap. weep hole - ELEV. 762.4 4" diameter, Class 160, PVC pipe ~ cement grout 11' bentonite seal જ hand-slotted 20' PVC pipe ~ 8 ELEV. 750.4 gravel pack 0 8 5' long Schedule 40 8 .020 PVC screen 8 .0 cap; æ ELEV. 742.4

MW 8-4

jest	Lake Cit	y AAP				Boring No. WW 8-4	Sheet 1 of
						Surface Elevation 762.4 Offset	
,ss				<u> </u>		Date Started 8/18/81 Completed	8/18/81
& State_	Indep	endenc	e, Mis	souri		Oriller T. Butler Rig	
•	•			Ab	brevistions:	A.O. — Auger Onty H.A. — Hollow Auger W.B. — Wash Bore R.B. — Rock Bit S.S. — Split Spoon S.T. — Shelby Tube	C.W. — Care W. C.A: — Care A: F.B. — Finger I
DE	PTH			TION RECORD	<u>}</u>	SAMPLE DESCRIPTION	
FROM	то	METHOD	POCKET PENETRO. METER	NO. OF	CORE	COLOR-MATERIAL-MOISTURE-CLAY	CONSISTENCY DENSITY
0.0'	3.5'	WB				Light brown silty clay, me	d. to sti:
3.5'	6.0'	WB		,		Light gray silty clay w/tr	ace sand,
5.0'	8.5'	WB	·			Dark brown silty clay w/tr to med.	ace sand,
B.5'	9.5'	WB				Green gray weathered shale	, med. to
9.5'	11.0'	SS1				Layered maroon & gray shal	y clay, me
11.0'	13.5'	WB				Same	
.3.5'	14.0'	WB				Light gray weathered shale	, soft to
14.0'	16.0'	WB				Maroon and light gray shal to med.	y clay, so
16.0'	19.5'	WB				Green gray weathered shale hard	e, med. to
19.5'	40.01	WB				Light gray shale, hard	
40.0'	Total	depth					
				ı			
	•						
MARKS: (Casing, Water	Loss, Etc	:.)		<u></u>	Static Water Level Time D	Pate
	1-1/2 b			PM	•	•	4/81 _{(Complet}
							

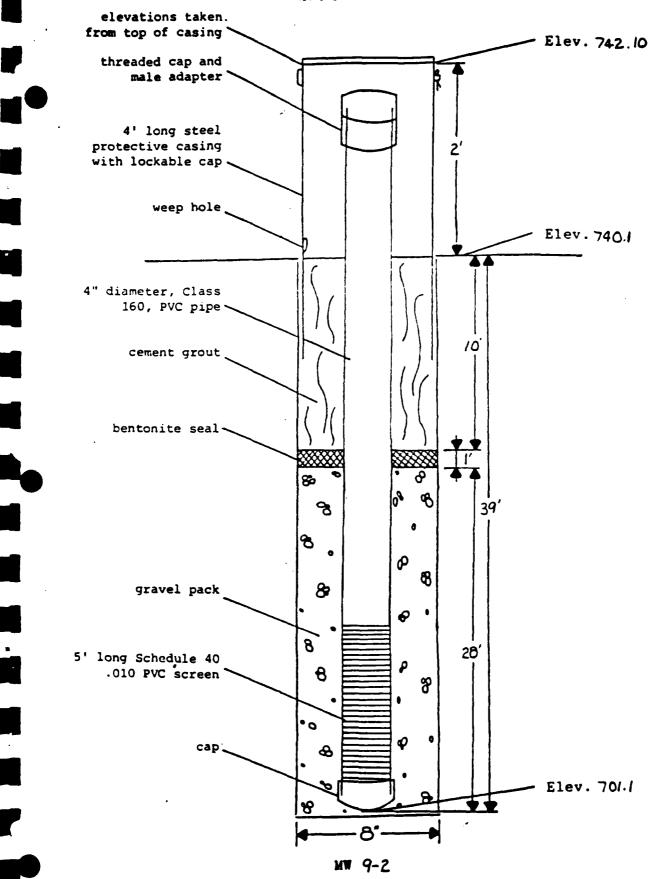
CONSTRUCTION OF WELL elevations taken. from top of casing - ELEV. 784.88 threaded cap and male adapter 4' long steel protective casing 2.1' with lockable cap weep hole ELEV. 782.8 4" diameter, Class 160, PVC pipe cement grout ID' bentonite sealhand-slotted 8 27' PVC pipe . જ ELEV. 771.8 8 gravel pack 8 16 8 16 cap. B ELEV. 755.8 MW 8-5

ject	Lake C	ity a	AP			Boring No XW 8-5		Sheet of _
_						Surface Elevation 782.8	Offse	t
%						Date Started 9/1/81	Completed	9/2/81
& State_	Indep	enden	ce, Mi	ssouri		Driller T. Butler	Rig	
•	•	•			bbrevietions:	H.A Hollow Auger S.S	Rock Bit Split Spoon Shelby Tube	C.W. — Core Wa C.A. — Core Air F.B. — Finger B
DE	PTH			TION RECOR	R 0	SAMPLE [DESCRIPTIO	N
FROM	то	МЕТНОВ	POCKET PENETRO- METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MO	DISTURE-CL	AY CONSISTENCY ND DENSITY
.0'	4.5'	WB				Light brown silty	clay, r	med. to stil
1.5'	6.0'	WB				Brown silty clay,	med to	stiff
5.0'	9.5'	WB				Gray silty clay, n	med. to	stiff
9.51	11.0'	SS1				Gray sandy clay, n	med. to	stiff
11.0'	14.0'	WB				Same		
4.0'	16.0	WB				Light tan silty c	lay, so	ft to med.
3.0'	24.0'	WB				Dark gray sandy st	ale, me	ed. to hard
4.0'	27.0'	WB				Light gray shale,	soft to	med.
7.0'	29.51	WB		·		Gray shale, med. t	o hard	
9.51	34.0'	WB				Marcon shale, soft	to med	i.
4.0'	36.5'	WB		*		Light gray shale,	soft to	med.
6.51	40.0'	WB				Gray shale, med. t	o hard	
0.0'	Total d	epth						
							 	
								
ARKS: (Casing, Water	Loss, Etc	.)		<u></u>	Static Water Level T	ime	Date
_	2 hours					15.9		/14/81 (Completic
								, 33



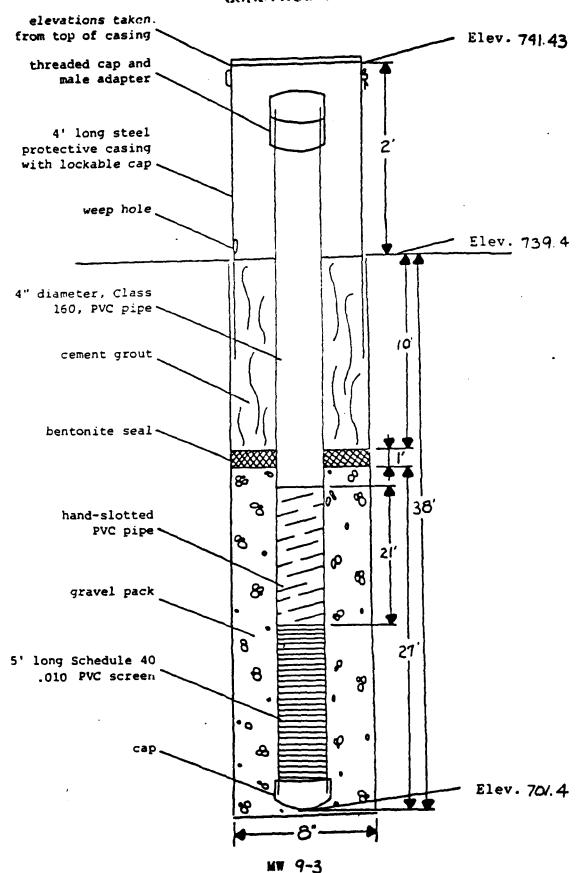
jectL	ake City	Army	Ammuniti	on Plant		Boring No. MW 9-1 Sheet 1 of _
						Surface Elevation 739.83 Offset
)ss <u>In</u>	dependenc	e, Mis	souri			Date Started 12/2/81 Completed 12/2/81
& State_	Indepen	dence.	Missour	<u>i </u>		Driller J. Von Holt Rig D=2
				Abb	reviations:	A.O Auger Only R.S Rock Bit C.W Core Wa H.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wash Bore S.T Shelby Tube F.S Finger B
DE	РТН			TION RECORD	<u></u>	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-SAND DENSITY
0.0'	0.5'	WB		: :		Gravel
0.5'	5.0'	WB	:	·		Dark brown silty clay, stiff
5.0'	12.0'	WB				Dark gray silty clay, stiff
12.0'	13.5'	STl	1.0		1.5'	Gray & trace/brown silty clay, medium
13.5'	19.0'	WB				Same
19.0'	34.0'	WB				Gray silty clay, medium
√ .0'	40.0'	WB				Gray fine to medium sand, w/trace of silt
40.0'	Total De	pth				
		<u> </u>		·····		
						,
						·
MARKS:	(Casing, Wate	r Loss, E	tc.)		•	Water Level Time Date
Sam	ple of Sa	nd 0 3	34' - 40			12.45 1/28/82 (Comple
Pumped	for 2.5 1	hours	6 GPM	,		_

CONSTRUCTION OF WELL ...

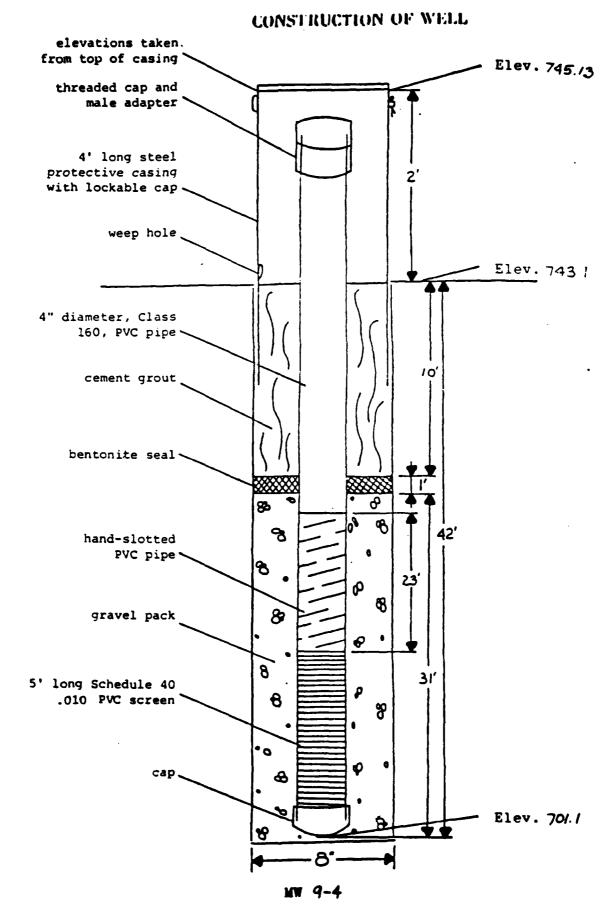


Project La	ke City A	rmy Am	munition	Plant		Boring No. 181 9-2	Sheet 1 of
						Surface Elevation 740.10 Of	fact
						Date Started 12/9/81 Complete	d <u>12/9/81</u>
ity & State_	Indepen	dence,	Missour	<u>i </u>	Oriller T. J. Butler Ri	D-2	
	•			Abi	orevietions:	A.O. — Auger Only R.B. — Rock Bit H.A. — Hollow Auger S.S. — Split Spoo W.B. — Wash Bore S.T. — Shelby Tu	n C.A Core A
DE	PTH			TION RECORD	RY	SAMPLE DESCRIPT	ION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF	CORE	COLOR-MATERIAL-MOISTURE-	CLAY CONSISTENCY SAND DENSITY
0.0'	2.5'	WB_				Brown silty clay, medium to s	soft
2.5'	9.0'	WB				Gray silty clay, medium to so	oft
9.0'	11.0'	WB				Gray silty clay, medium to st	iff
11.0'	12.5'	WB				Gray silty clay, trace/sand a medium to soft	weathered sha
12.5'	14.0'	ST1			1.5'	Gray silty clay, trace/sand,	stiff
4.0'	20.01	WB				Gray silty clay, medium to so	oft
20.0'	32.5'	WB				Blue gray clay, medium to st	ff
32.5'	40.01	WB				Silty fine to medium fine sar	nd
40.0'	Total De	th					
				··			
							•
				· - - · · · · · · · · · · · · · · · · · ·			
	·		+ - +				
],	++	<u> </u>	 		
SMARKS:	Casing, Wate	t lon F	<u></u>			Water Level Time	Date
_	ole of sa			0'		15.40	1/29/82 (Compli
	for 1 hou						
	Vestern			Inc.	(C-266	

CONSTRUCTION OF WELL



oje L	ake City A	Letiny Am	munition	Plant		Boring No. <u>MW 9-3</u>	Sheet of
						Surface Elevation 739.43 Offse	t
.ddress				.· 	 -	Date Started 12/3/81 Completed	12/3/81
ity & State	Independ	lence.	Missouri			Oriller J. Von Holt Rig	
				АЫ	breviations:	A.O Auger Only H.A Hollow Auger W.B Wash Bore R.B Rock Bit S.S Split Spoon S.T Shelby Tube	C.W. — Core Wate C.A. — Core Air F.B. — Finger Bit
D	EPTH		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION	ON
FROM	то	МЕТНОВ	PUCKET PENETRO METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-SAI	AY CONSISTENCY ND DENSITY
0.0'	0.5'	WB				Gravel	·
0.5'	7.0'	WB				Dark brown silty clay, stiff	
7.01	12.0'	WB		!		Dark gray silty clay, stiff	•
12.0'	14.0'	WB				Brown & gray silty clay, stiff	
14.0'	15.5'	ST1	2.0		1.5	Same	
.51	27.0'	WB				Same	
27.0'	33.0'	WB				Gray silty clay, medium	
33.0'	40.0'	WB				Gray fine to medium sand w/tra	ce of silt
40.0'	Total De	pth					
·							
·				•			
							.
				1			
							•
					<u> </u>		
EMARKS:	(Casing, Wate	r Loss, E	tc.)			Water Level Time	Date
Jag San	ple of San	nd 0 33	3' - 40'				1/28/82 (Complet
Pumped :	for 3 hour	* • 6	GPM	С	-268		



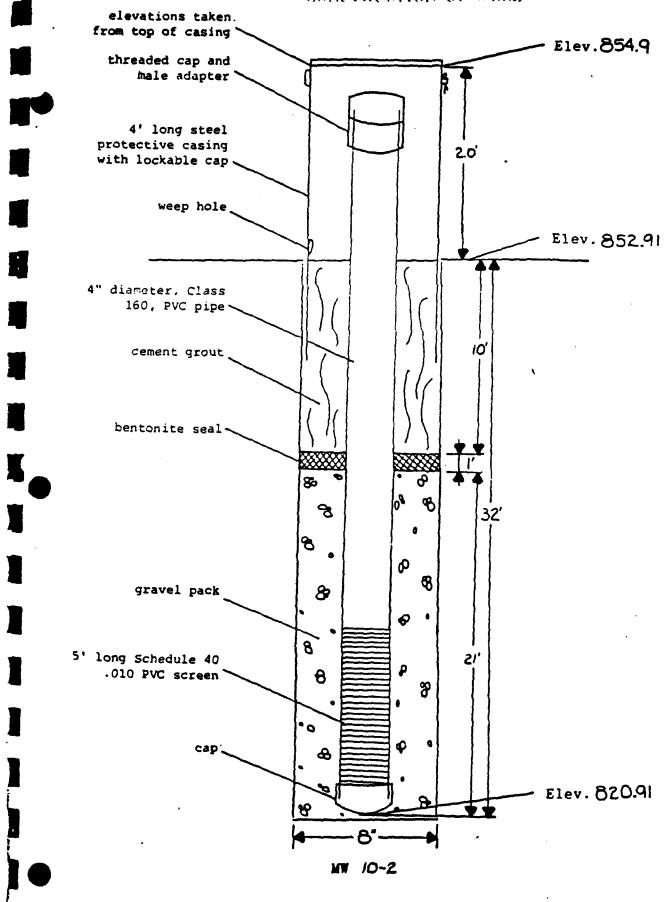
nct Lak	e City Ar	my Amer	unition	Plant		Boring No. MW 9-4		Sheet of
			·			Surface Elevation 743.0	3 Offset	
dress						Date Started 12/4/81	Completed _	12/4/81
y & State_	Independ	ence,	Missouri			Driller J. Von HOlt	Rig	D-2
				Abt	previations:	H.A Hollow Auger S.S	- Rock Bit - Split Spoon - Shelby Tube	C.W. — Core W C.A. — Core A F.B. — Finger
DE	РТН			TION RECORD	صم ا	SAMPLE	DESCRIPTION	1
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF	CORE	COLOR-MATERIAL-N	OISTURE-CLA	Y CONSISTENCY D DENSITY
0.0'	1.0'	WB				Gravel		
1.0'	11.0'	WB				Dark brown silty clay	, stiff	
11.0'	18.0'	WB				Brown & gray silty cl	ay, stiff_	•
18.0'	19.5'	ST1	1.5		1.5'	Brown & gray silty cl	ay, stiff	
19.5'	27.0'	WB				Same		
7.0'	36.0'	WB		·		Gray silty clay, medi	um	
36.0'	40.0'	WB				Gray fine to medium s	and w/trace	e of silt
40.0'	Total Dep	th						· · · · · · · · · · · · · · · · · · ·
			ļļ.					
				•				
	ļ	ļ						
-								
							·—·	
		<u> </u>				<u> </u>		
244 0 40	(Casing, Water	r Loss, E	tc.)			Water Level	Time	Date
MANKS:								

CONSTRUCTION OF WELL clevations taken. from top of casing ___ Elev.856.6 threaded cap and male adapter 4' long steel protective casing 1.9' with lockable cap. weep hole Elev 854.74 4" diameter, Class 160, PVC pipe -10 cement grout bentonite seal ~ 8 18 જ 8 gravel pack 8 P 8 5' long Schedule 40 .010 PVC screen θ B • 0 cap. B Elev. 836.74 MM 10-1

ject <u>Lake</u>	City Arm	Ammu	nition	Plant		Boring No. MW 10-1 Sheet 1 of
			<u> </u>			Surface Elevation 854.74 Offset 10' E. of 10
aress						Date Started 1/8/82 Completed 1/8/82
y & State	Indepe	ndence	, Misso	uri		Driller T. Butler Rig D-2
				Abb	revistions:	A.O. — Auger Only R.S. — Rock Bit C.W. — Core Wa H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.S. — Finger B
DEF	тн			TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO- METER	NO OF	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	4.0'	WB		İ		Dark brown silty clay, slightly moist, med to soft
4.0'	9.5'	WB				Dark brown silty clay, slightly moist, soft to med.
9.5'	13.0'	WB		·		Same
13.0'	15.0'	WB				Brown silty clay, very moist, soft to very
15.0'	16.5'	STl	1.5			Same
16.5'	17.0'	WB				Same
17.0'	18.0'	WB			•	Limestone
18.0'	Refusal					
						
						
WARKS: (Casing, Water	Loss, E	tc.)			Water Level Time Date
	·				· • · · · · · · · · · · · · · · · · · ·	(Comple
-						

gyne-Western Company,Inc.

Hect	e City Ar	my Am	munition	Plant		Boring No. 10-1 Sheet 1 of 1					
						Surface Elevation Offset					
dress						Date Started 1/4/82 Completes 1/4/82					
& State_	Independ	ence,	Missouri			Driller T. Butler Rig D-2					
-				Abb	reviations:	A.O Auger Only R.B Rock Bit * C.W Core Water H.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wesh Bore S.T Shelby Tube F.B Finger Bit					
DEI	PTH			TION RECORD	÷	SAMPLE DESCRIPTION					
FROM	то	МЕТНОО	POCKET PENETRO. METER	NO OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY					
0.0'	4.5'	AO				Dark brown silty clay, slightly moist, med.					
4.5'	10.0'	AO				Dark brown silty clay, slightly moist, soft med.					
10.0'	14.0'	AO				Same					
14.0'	20.0'	AO				Brown silty clay, very moist, soft to very s					
20.0'	22.0'	AO				Same					
.0'	Refusal										
		_									
				·							
			-	,							
			-								
			-								
AKS: (0	Casing, Water (Loss, Et	c.)			Water Level Time Date 16.0 1:30 pm 1/4/82 (Completion					



	City Arm	7				Boring No. 10-2 Sheet 1 of
						Surface Elevation Offset
ress				<u></u>		Date Started 1/4/82 Completed 1/4/82
& State_	Indepen	dence,	Missou	ri		Driller T. Butler Rig D-2
				Abb	reviations:	A.O Auger Only R.B Rock Bit C.W Core to H.A Hallow Auger S.S Split Spoon C.A Core to W.B Wash Bore S.T Sheiby Tube F.B Finger
DEP	тн		<u> </u>	TION RECORD		SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	5.0	AO	-			Dark brown silty clay, slightly moist, med to soft
5.0'	10.0'	AO		 		Same
10.0'	15.0'	AO .				Same
15.0'	21.0'	AO				Same
21.0'	25.0'	AO				Light brown shaly clay, slightly moist, med. to hard
25.0'	30.0'	AO				Same
30.0'	32.0'	AO				Same
32.0'	40.0'	AO				Gray shale, dry, med. to hard
40.0	Total d	epth		·		
				_		
-	·					
MARKS: (C	Casing, Water	Loss, Etc	<u></u>			Water Level Time Date
						Dry 12:15 pm 1/4/82 (Con

	e City A	my Augu				Boring No. MW 10-2 Sheet Lof
						Surface Elevation 852.91 Offset 5' E. of 10
·s	-	.				Date Started 1/9/82 Completed 1/9/82
& State_	Indeper	dence,	Missou			Driller T. Butler Rig D-2
				Abb	rėviations:	A.O Auger Only R.B Rock Bit C.W Core M.A Hollow Auger S.S Split Spoon C.A Core A.W.B Wash Bore S.T Shetby Tube F.B Finger
DEF	тн			TION RECORD	Я	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	5.0'	WB		ļ		Dark brown silty clay, slightly moist, med. to soft
5.0'	10.0'	WB				Same
10.0'	15.0'	WB		ļ		Same
15.0'	21.0'	WB				Same
21.0'	25.0'	WB				Light brown shaly clay, slightly moist, med. to hard
25.0'	30.0'	WB				Same
0.0'	32.0'	WB				Gray shale, dry, med. to hard
32.01	Total o	lepth				·
		ļ				
		ļ				
MARKS: (Casing, Wate	r Loss, Et	c.)			Water Level Time Date
-	· · · · · · · · · · · · · · · · · · ·					

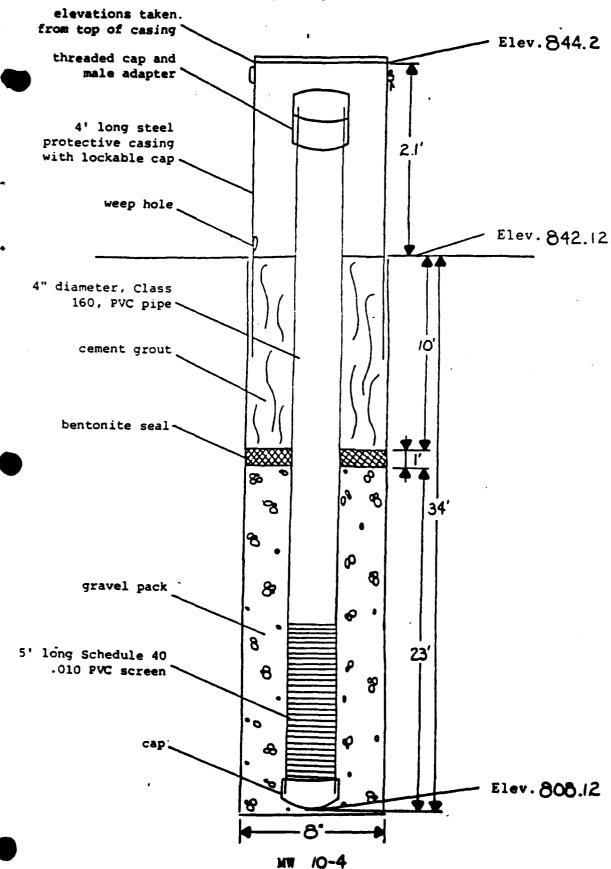
CONSTRUCTION OF WELL elevations taken. from top of casing - Elev. 837.4 threaded cap and male adapter ` 4' long steel protective casing 1.9' with lockable cap: weep hole. El'ev. 835.49 4" diameter, Class 160, PVC pipe Id cement grout bentonite seal-8 23 8 O 8 gravel pack 8 P 8 5' long Schedule 40 12' .010 PVC screen в cap, æ Elev. 812.49

8"-

MW 10-3

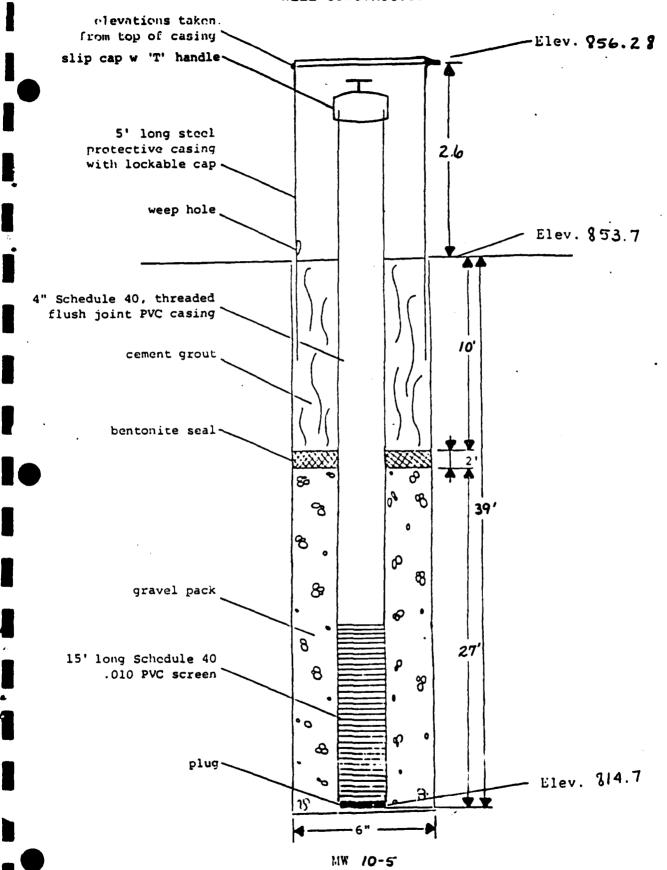
City Ar	my Amm	unition	Plant		Boring No. MW 10-3	Sheet 1 of
					Surface Elevation 835.49 Offset	
					Date Started 1/4/82 Completed	1/4/82
Indepe	ndence,	Missou	ri		Driller T. Butler Rig _	D-2
			Abb	reviations:	H.A Hollow Ayer S.S Split Spoon	C.W. — Core Wa C.A. — Core Air F.B. — Finger B
тн		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION	
то	METHOD	POCKET PENETRO METER	NO OF	CORE RECOVEI	COLOR-MATERIAL-MOISTURE-CLA'	Y CONSISTENCY D DENSITY
5.0'	AO		İ		Dark brown silty day, slightly med. to soft	moist,
7.0'	AO		į		Same	
12.0'	AO				Dark gray silty clay, slightly to med.	moist, soft
15.0'	AO				Dark brown silty clay, slightly to soft	moist, med.
21.0'	AO		į		Same	
25.0'	AO			•	Light brown shaly clay, slight! to hard	y moist, me
30.0'	AO				Same	
35.0'	AO				Same	
40.0'	AO	-			Same	
Total o	epth					
·						
						•
						
						•
asing Water	Los, Etc	a) ot hole	for well.		Water Level Time D)ate
2 WB hol	e for	monitori	ng well wi	th a	Dry 3:00 pm 1/	4/82 (Comp
•						5/82
	Indepe TH TO 5.0' 7.0' 12.0' 15.0' 21.0' 25.0' 30.0' 35.0' 40.0' Total of the contro	TH TO HE STATE OF THE STATE OF	Independence, Missou TH TO H W S S S S S S S S S S S S	TH TO TO TO TO TO TO TO TO TO	Independence, Missouri TH PENETRATION RECORD TO TO TO TO TO TO TO TO TO TO TO TO TO T	Surface Elevation B35.49 Offset

CONSTRUCTION OF WELL



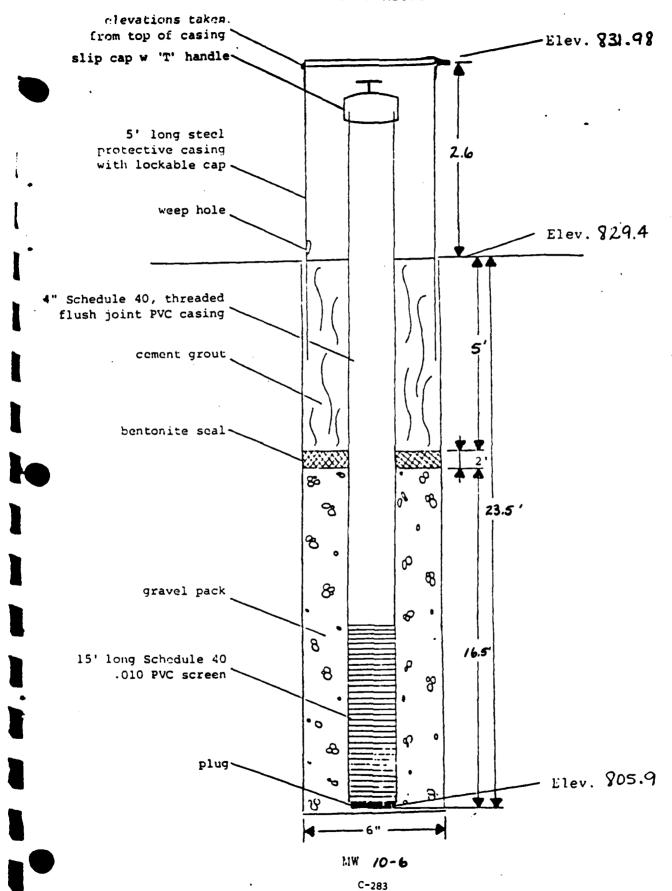
City Arm	y Ammur	ition P	lant		Boring No. MW 10-4 Sheet 1 of 1
					Surface Elevation 842.12 Offset
					Date Started 1/4/82 Completed 1/4/82
Indeper	ndence,	Missou	ri .	•	Driller T. Butler Rig D-2
			Ab	breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Wate H.A. — Hotlow Auger S.S. — Solit Spoon C.A. — Core Air W.B. — Wesh Bore S.T. — Shelby Tube F.B. — Finger Bit
РТН	1	PENETRAT	TION RECORD		SAMPLE DESCRIPTION
то	МЕТНОВ	POCKET PENETRO METER	NO OF	CORE	COLOR-MATERIAL-MOISTURE_CLAY CONSISTENCY SAND DENSITY
5.0'	AO				Dark brown silty clay, slightly moist, med. to soft
10.0'	AO				Same
15.0'	AO			!	Dark brown silty clay, moist, soft to med.
20.0'	AO				Same -
25.0') AO			!	Same
31.0'	AO				Dark brown silty clay, very moist, soft to med.
31.5'	AO				Gray shale, dry, hard
40.0'	AO ·				Gray shale, dry, med. to hard
Total d	epth				
				i	
	Markan				
			Ar y		
					f
					Water Level Time Date
			I W	ith a	24.0 2:00 pm 1/4/82 (Completic
	Indeper PTH TO 5.0' 10.0' 15.0' 20.0' 31.0' 31.5' 40.0'	Tndependence, PTH TO TO TO TO TO TO TO TO TO	To PENETRAL TO PENETRAL TO PENETRAL ON MANAGEMENT AND P	PTH TO	Tindependence, Missouri

WELL CONSTRUCTION



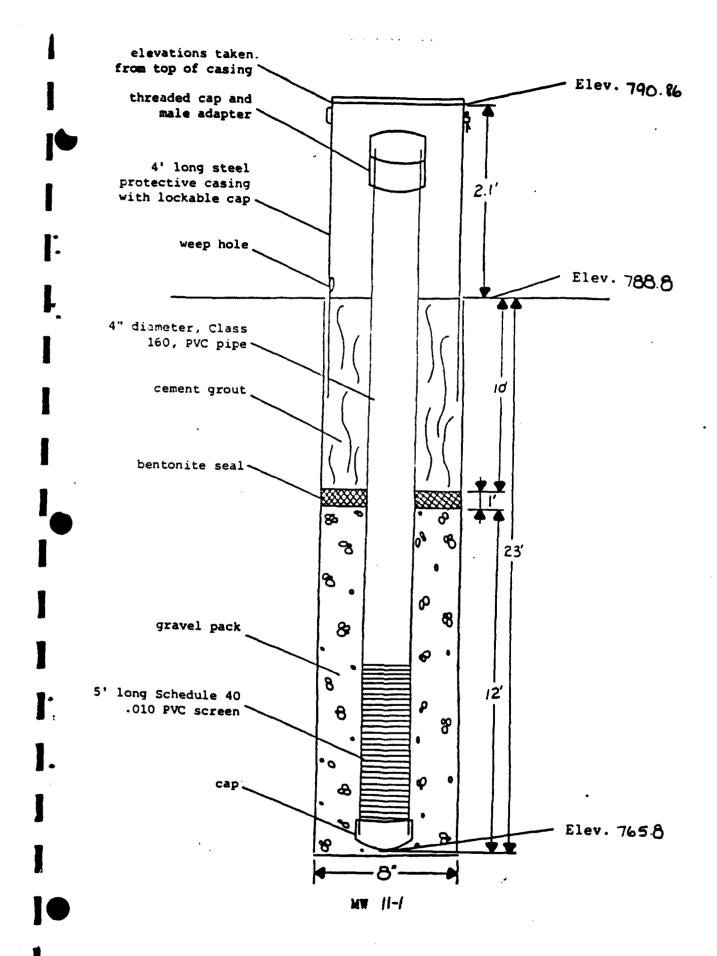
ject <u>. La</u>	ke City	yrmy y	mmunitio	n Plant		Boring No. <u>MN 10-5</u> Sheet <u>1</u> of
						Surface Elevation 829.4 Offset
•						Date Started 1/5/83 Completed 1/6/83
& State	Indepe	ndence	, Missou	ri		Driller B. Blank Rig AD-2
				Abb	reviations:	A.O. — Auger Only H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Mate W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DEP	TH			TION RECORD	Ä	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO. METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	3.01	на				Brown sandy clay (fill) moist, very stiff
3.0'	13.5'	на				Brown silty clay, moist, very stiff
13.5'	24.5'	на				Brown silty clay w/trace sand, moist, very
24.5'	26.0'	STl	2.25		1.5'	Same
26.0'	33.5'	на				Same
33.5'	39.0'	на				Dark gray shale, dry, med. to hard
0,	Total	epth			-	
						
					ٺ ــــــــــــــــــــــــــــــــــــ	
IARKS: (C	asing, Water	Loss, Et	c.)			Water Level Time Date
						Dry3:00pm1/5/83(Completic

WELL CONSTRUCTION



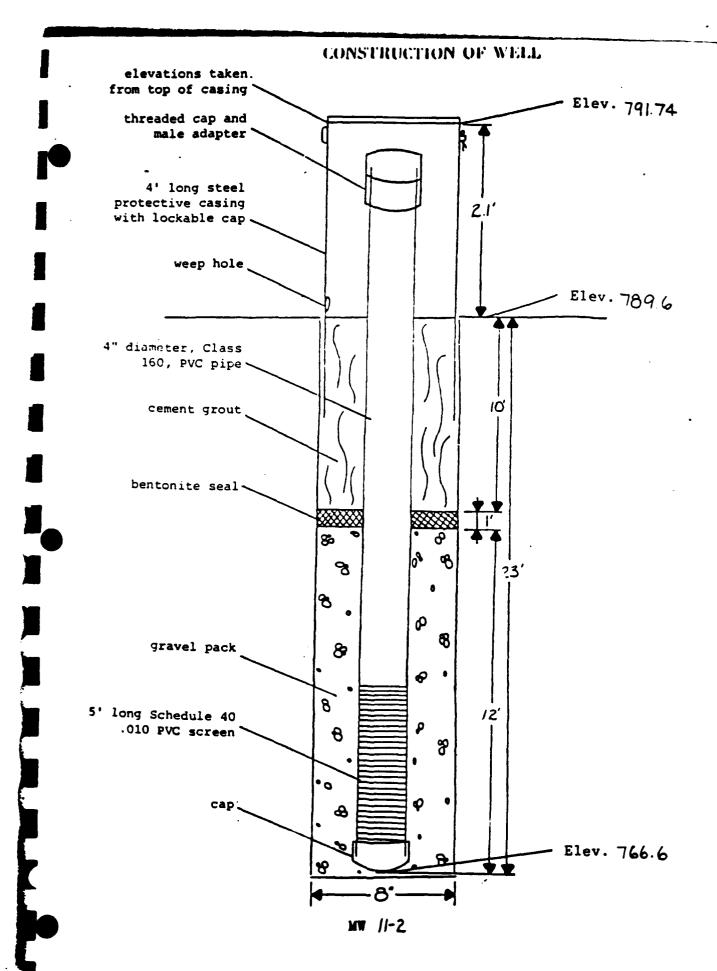
						Surface Eleva			Offset		
						Date Started					33
y & State_	Indepen	dence	, Missou	ri ———		Driller B.	Blank	<u> </u>	Rig _	AD-2	2
				Al	bbreviations:	A.O Auga H.A Holid W.B Wash	w Auger	R.B R S.S S ₁ S.T SI	plit Spoon	C.A.	Core WaterCore AirFinger Bit
DE	PTH			TION RECOR	₽ }		SA	MPLE DE	SCRIPTIO	N	
FROM	то	МЕТНОВ	POCKET PENETRO- METER	NO OF BLOWS	CORE RECOVERY	COFO	R-MATER	IAL-MOIS	TURE-CLA	Y CONSI	STENCY TY
0.0'	0.61	на				Topsoil					
0.6'	2.0'	на				Brown sil	ty clay	, moist	very	stiff	_
2.0'	5.5'	на				Olive bro					
5.5'	11.0'	на				med. to h		Snare,	stight		
11.0'	13.0'	на				Brown & g	ard				
.0'	13.9'	на				Brown bromed. to h		thered	sandsto	one, si	lightly m
9.9	14.8'	на				Brown wea		sandsto	one, sli	ightly	moist,
14.8'	23.5'	на				Gray shal	e, very	moist	, med. 1	to hard	1
23.5'	Refusal				-						
					-				·		
							 -		 -		
										···-	
ARKS:	(Casing, Water	Loss, E	tc.)		<u></u>	Wat	er Level	Tim	ne	Date	
						1	.0.0	12:10)pm 1,	/5/83	(Completio

tayne-Western Company, Inc. c-284



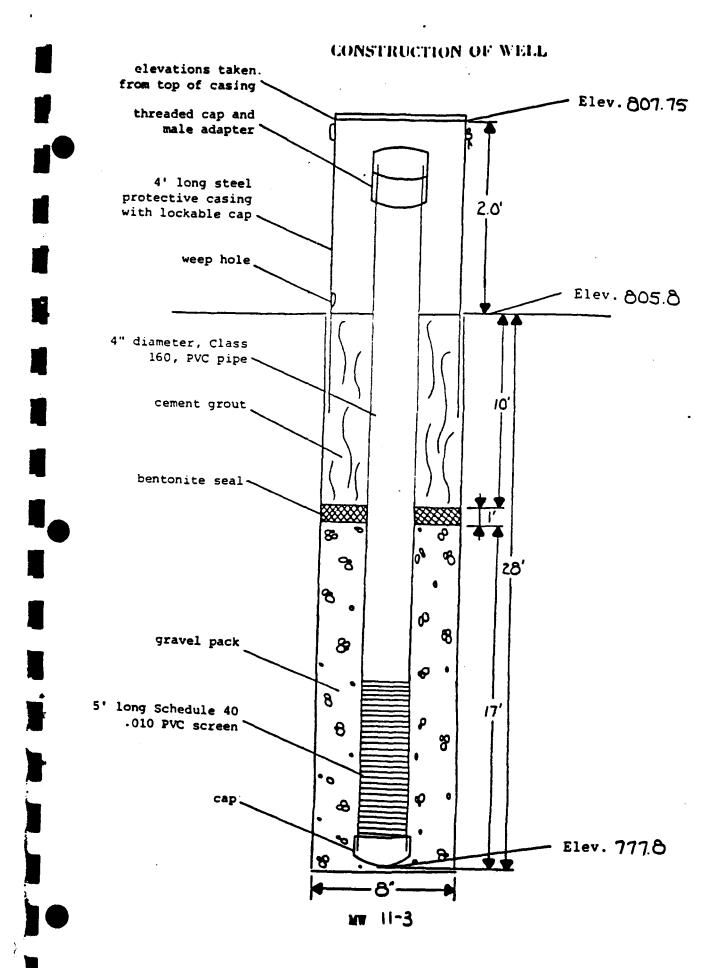
ojectI	ake City	Army A	mmunitio	n Plant		Boring No. No. 11-1 Sheet 1 of 1
						Surface Elevation 788.76 Offset
dr						Date Started 12/14/81 Completed 12/14/81
y & State_	Indepen	dence,	Missour	<u>i</u>		Driller T. J. Butler Rig D-2
				Abb	previations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Water H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger Bit
DE	PTH			TION RECORD	RY	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0	1.0'	WB				Dark brown silty clay, medium to soft
1.0'	5.0'	WB				Brown silty clay, medium to soft
5.0'	10.0	WB				Same
10.0'	13.0'	WB				Same
13.0'	22.0'	WB				Light brown silty clay, moist, soft to medium
<u>. ال</u>	23.0'	WB			············	Gray shale
23.0'	Total De	eth	-			
		 			 _	
						
		,				
MARKS:	Casing, Water	Loss, Et	<u></u>		2	Water Level Time Date
Pared_	for 2 hour	S. Pur	mped 1/2	GPM.not s	teadily	9.7 1/28/82 (Completion

:t_Lak	e City Ar	ту Але	munition	Plant		Boring No. 11-1	Sheet <u>1</u> of <u>1</u>
					·	Surface Elevation Of	feet
						Date Started 12/9/81 Complet	ed 12/9/81
& State_	Independ	ence,	Missouri	·		Driller T. J. Butler Ri	9D-2
				Abt	previations:	A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit S.S. — Split Spoo	O CA - Core Air
DE	PTH		 	TION RECORD	BY	SAMPLE DESCRIPT	TION
ROM -	то	МЕТНОВ	POCKET PENETRO METER	NO. OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-	CLAY CONSISTENCY SAND DENSITY
0.0'	1.0'	AO				Dark brown silty clay, moist,	medium to soft
١,٥٠	13.0	AO				Brown silty clay, moist, med	ium to soft
.0'	23.01	AO				Light brown silty clay, moist	t, soft to media
.0'	25.0'	AO				Gray shale, dry, hard	•
.0'	Total Dep	th				·	
					``		
							
							-
							
		·					
	Casing, Water	Loss, Et	L.)			Water Level Time	Date
er pu	lling ang	ere. h	eard wat	er bubbli			_12/9/81 (Completic
hole,	probably	a poc	ket of m	ethane gas	8.		



Project La	ke City Ar	my Amn	unition	Plant	Boring No. MW 11-2 Sheet 1					
						Surface Elevation 789.64	Offset 10' W of 11-			
ddress	<u> </u>					Date Started 12/15/81 Comp	pleted 12/15/8;			
ity & State	Independ	lence,	Missouri			Driller T. J. Butler	Rig <u>D-2</u>			
4				Abb	oreviations:	A,O. — Auger Only R.B. — Rock I H,A. — Hollow Auger S.S. — Split S W.B. — Wesh Bore S.T. — Shelby	poon C.A Core Air			
DI	EPTH	J	<u> </u>	TION RECORD	≻	SAMPLE DESCR	IPTION			
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF	CORE RECOVERY	COLOR-MATERIAL-MOISTUR	E-CLAY CONSISTENCY SAND DENSITY			
0.0'	1.0'	WB_				Dark brown silty clay, med	ium to soft			
1.0'	5.0'	WB				Brown silty clay, medium	to soft			
5.0'	10.0'	WB		_		Same	• ,			
10.0'	12.0'	WB				Same				
2.0'	13.0'	WB				Light brown silty clay, so	ft to medium			
13.0'	14.5'	STI	0.5			Light brown silty clay, so	ft			
14.5'	21.0'	WB				Light brown silty clay, so	£t			
21.0'	23.0'	WB				Gray shale, medium to hard				
23.0'	Total De	pth								
			1							
		-								
······	<u> </u>		-			<u> </u>				
	<u></u>									
	-	 								
	<u></u>	<u> </u>		<u> </u>	<u> </u>					
	(Casing, Wate					Water Level Time	Date			
Pumped	for 1.5 h	ours,	Pumped 3	GPM stea	dily		1/28/82 (Comple			
,	"	^		•		C-289				

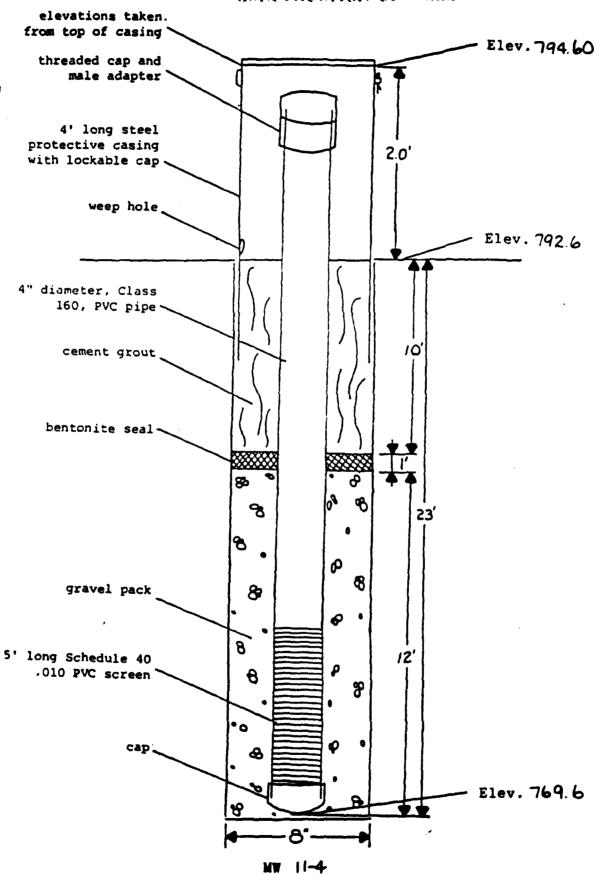
ject <u>La</u>	ke City A	rmy Am	munition	Plant		Boring No. 11-2 Sheet 1 of 1
						Surface Elevation Offset
D						Date Started 12/9/81 Completed 12/9/81
& State_	Independ	ence,	Missouri			Driller T. J. Butler Rig D-2
				Abi	previations:	A.Q Auger Only H.A Hollow Auger W.B Wesh Bore R.B Rock Bit C.W Core Wai C.A Core Air F.B Finger B
DE	РТН		PENETRA	TION RECORD	>	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO METER	NO OF	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0'	1.0'	AO	!			Dark brown silty clay, moist, medium to soft
1.0'	12.0'	AO				Brown silty clay, moist, medium to soft
12.0'	21.0'	AO				Light brown silty clay, moist, soft to media
21.0'	23.0'	AO				Gray shale, dry, hard
23.0'	Total De	pth				
	7					
 			+		-	
		-	-		-	
		-	+			
	<u> </u>	-				
		+				
		<u></u>			<u> </u>	
n .KS:	(Casing, Wate	er Loss, E	itc.)			Water Level Time Date
-0 -						(Comple



et <u>Lak</u>	e City Ar	my Ama	munition	Plant		Boring No Sheet _1 _ of 1
_						Surface Elevation 805.74 Offset
dress	·			, ·		Date Started 1/13/82 Completed 1/14/82
ity & State_	Indeper	dence	, Missou	ri		Driller T. Butler Rig D-2
		- "			reviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Core Way H.A. — Hollow Auger S.S. — Split Spoon C.A. — Core Air W.B. — Wash Bore S.T. — Shelby Tube F.B. — Finger 3
DEF	тн		——	TION RECORD	Æ	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETHO- METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
0.0'	0.5'	WB				Topsoil
0.5'	5.0'	WB				Dark brown silty clay, med. to soft
5.0'	10.0'	WB				Same
10.0'	15.0'	WB				Same
15.0'	17.5'	WB				Same
17.5'	20.0'	WB				Light brown silty clay, soft to med.
20.0'	25.0'	WB				Same
25.0'	26.5'	WB				Same
26.5'	27.5'	WB				Brown shaly clay, med. to stiff
27.5'	35.0'	WB				Gray shale, stiff to med.
35.0'	36.5'	WB				Gray shale, very stiff to hard
36.5'	40.0'	WB				Light gray shale, hard to very stiff
40.0'	Total o	epth				
EMARKS: (Casing, Wate	r Loss, E	tc.)			Water Level Time Date
						10.6 1/28/82 (Comple

	e City Ar				_ 	Surface Elevation Offset	<u>.</u> .
idress						Date Started 12/9/81 Completed 12/9/81	<u> </u>
ry & State_	Indepen	dence	Missou	ri		Driller T. J. Butler Rig D-2	
				Abi	Oftviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — H.A. — Hollow Auger S.S. — Spirt Spoon C.A. — W.B. — Wash Bore S.T. — Shelby Tube F.B. —	Core
DE	PTH		PENETRA	TION RECORD	>	SAMPLE DESCRIPTION	
FROM	то	МЕТНОБ	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSIST	ENC
0.0	8.0'	AO				Light tan shaley clay, slightly moist to stiff	, me
8.01	9.0'	AO				Brown shaley clay, slightly moist, so	ft
9.01	13.0'	AO				Light tan shaley clay, slightly moist to stiff	
13.0'	16.0'	AO				Light tan shaley clay, slightly moist to medium	
16.0'	18.0'	AO				Light tan shaley clay, slightly moist to stiff	·
18.0'	19.0'	AO				Red brown shaley clay, slightly moist to soft	
19.0'	23.0'	AO				Light tan shaley clay, slightly moist to soft	, m
23.0'	24.0'	AO				Light gray shale, dry, hard	
24.0'	Total de	oth					
			-				
			+	 			—
							—
			+				—
EMARKS:	(Casing, Water	Loss, E	tc.)			Water Level Time Date	=
cation a	bandoned					Dry 12:00pm 12/9/81	·C

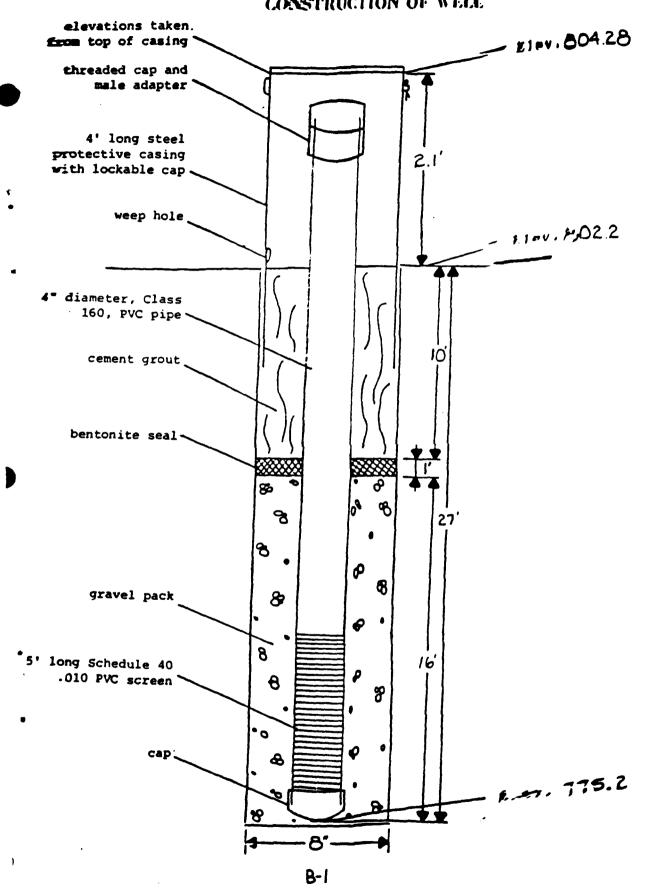
CONSTRUCTION OF WELL



						Surface Elevation 792.60 Offset 5' W of 11-
						Date Started 1/12/82 Completed 1/12/82
& State	Indepe	ndence	, Missou	ıri ´		Driller Rig D-2
				Abi	brevietions:	
DEF	тн		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENE I RO METEH	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0	1.0'	WB	!		!	Topsoil
1.0'	5.0'	WB				Dark brown silty clay, med. to soft
5.0'	10.0	WB				Same
10.0'	13.0'	WB				Same .
13.0'	15.0'	WB				Light brown silty clay, soft to med.
5.0'	20.0'	WB				Same
0.0'	23.0'	WB				Same
23.0'	24.0'	WB			,	Gray shale, stiff to med.
24.0'	Total o	epth				
			-			
						,
MARKS: (Casing, Wate	Loss, E	<u> </u>			Water Level Time Date
						4.2 1/28/82 (Compli
7						

oject <u>La</u>	ke City	AFRY A	munitio	n Plant		Boring 1	No. <u>11</u>	-4		_ Shee	t_1_ of _
-		, ,				Surface	Elevation_		Offse	n	
ddress						Date St	arted 12	/9/81	Completed	12/	9/81
ty & State_	Inderand	dence,	Missour	<u>i</u>	***	Driller_	T. J.	Butler	Rig		D-2
				Ab	breviations:	H.A	Auger Only Hollow Aug Wash Bore	er S.S.	- Rock Bit - Split Spoon - Shelby Tube	C.A.	- Core Wa - Core Ai - Finger 8
DE	РТН		PENETRA	TION RECORD	<u>}</u>			SAMPL	E DESCRIPTION	ON	
FROM	то	ME THOD	POCKET PENETRO. METER	NO OF BLOWS	CORE		COLOR-MA	ATERIAL-	MOISTURE-CL	AY CONS	SISTENCY
0.0	1.6:	! 				Top so	oil				
1.0'	13.6	AO				Brown	silty c	lay, mo	ist, medi	ım to	soft
13.0'	23.01	AO				Light	brown s	ilty cl	ay, moist	soft	to medi
23.0'	24.71	AO				Light	gray sh	ale, dr	y, hard		
24.0'	Total de	epth									
									<u>-</u>		
				······································							
											4
		 	1						<u> </u>		
		+									
		-			 	-					
		+-									
PMAKS:	(Caring Wee	er Loui, (itc.)		<u></u>		Water Le	rel	Time	Date	
										<u>,</u> -	(Complet
					C-29	6					_

CONSTRUCTION OF WELL



ject	Lake City	Army	Ammuniti	on Plant		Boring No. B-1 Shert 1
						Surface Elevation 802.2 Offset
)en						Date Started 1/18/82 Completed 1/18/82
& State_	Indepen	dence,	Missour	<u>i</u>		Driller T. J. Butler Rig D-2
				Abi	breviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — Cor. H.A. — Hollow Auger S.S. — Split Spoon C.A. — Cor. W.B. — Wash Bore S.T. — Shelby Tube F.B. — Fin
DE	PTH		PENETRA	TION RECORD	}	SAMPLE DESCRIPTION
FROM	то	METHOD	POCKET PENETRO METER	BLOWS	CORE	COLOR-MATERIAL-MOISTURE-SAND DENSITY
0 .0'	3.0'	WB			 	Dark brown silty clay, medium to soft
3.0'	5.5'	WB				Dark gray silty clay, medium to soft
5.5'	10.0'	WB				Brown silty clay, w/trace weathered shall medium to soft
10.0'	14.0'	WB				Same
14.0'	20.0	WB				Light brown silty clay, soft to very soft
30.01	22.5'	WB			1.	Same
2.5'	27.0'	WB	+		 	Light gray shaley clay, medium to stiff
27.0'	34.0'	WB				Gray shale medium to stiff
34.01	40.0'	WB				Light gray shale, stiff to medium
40.0'	Total De	pth	-		-	
		+	-			
	-	+				
	 	+	+	·	-	
	 	+	+		-	
<u> </u>		+	++		1	
MARKS:	(Casing, Wet	er Loss, I	inc)		<u> </u>	Water Level Time Date
<u> </u>			***************************************			(Con
The same	or 2 hrs	Pur	npany.	not ste	adily	7.3 1:30P.M. 2/15/82

CONSTRUCTION OF WELL elevations taken. from top of casing ___ Elev. 753.08 threaded cap and male adapter 4' long steel protective casing with lockable cap 2.1 weep hole Elev. 750./ 4" diameter, Class 160, PVC pipe cement grout 10 bentonite seal 80 8 8 gravel pack 4 10' long Schedule 40 8 .010 PVC screen 8 14 cap. B Elev. 690.3 8.

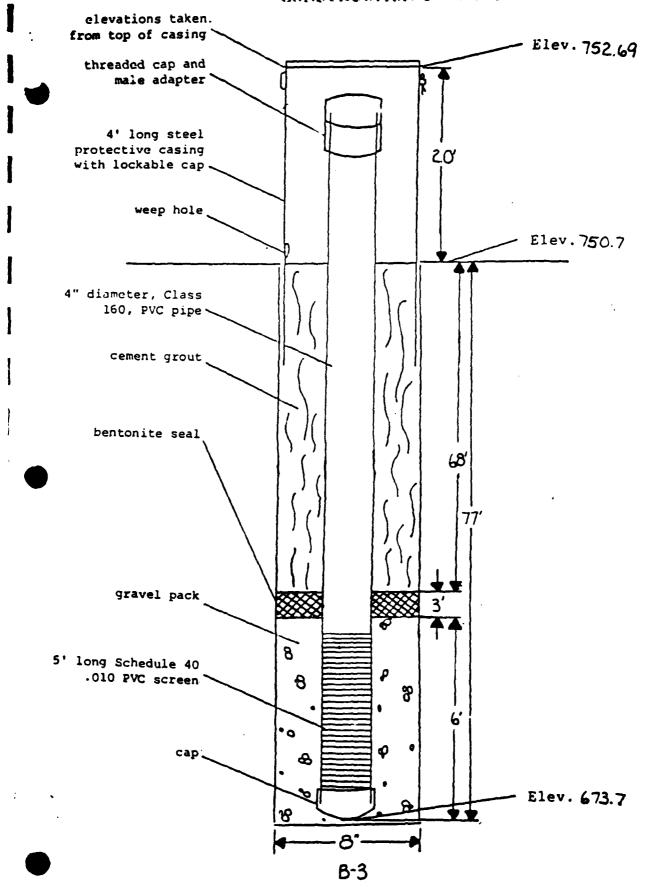
8-2

ect <u>Lak</u>	e City Ar	ny Amm	unition	Plant		Boring No. <u>B-2</u> Sheet <u>2</u> of <u>2</u>
						Surface Elevation Offset
ir						Date Started 2/2/82 Completed 2/3/82
/ & State_	Independ	ence,	Missouri			Driller T, Butler Rig D-1
				Abb	previations:	A.O Auger Only R.B Rock Bit C.W Core Water H.A Hollow Auger S.S Split Spoon C.A Core Air W.B Wesh Bore S.T Shelby Tube F.B Finger Bit
DE	PTH			TION RECORD	RY	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY SAND DENSITY
69.0	70.0	WB		,		Limestone
70.0	74.5	WB				Dark gray shale, hard
74.5	75.5	WB				Light gray limy shale, medium to stiff
75.5	78.0	WB				Light gray limy shale, stiff to hard
78.0	Total D	oth_				
•						
			-			
				:		
			-			
· · · · · · · · · · · · · · · · · · ·			-			
		-	++			
P . 9KS:	(Casing, Wate	r Loss F	<u> </u>			Water Level Time Date
_	er 1.5 ho					Water Level Time Date
	teady & c	lear (Total De	oth of Wel	L1 = 60	· · · · · · · · · · · · · · · · · · ·
yne-L	Vestern	Com	nanı	Inc		C-300

j Oject <u>Lak</u>	city Ar	ny Amm	unition	Plant		Boring No. B-2 Sheet 1 of 2
						Surface Elevation 751.0 Offset
idr						Date Started 2/2/82 Completed 2/3/82
y & State_	Independe	ence.	Missouri	<u> </u>		Driller T. Butler Rig D-1
						A.O. — Auger Only H.A. — Hollow Auger W.B. — Wesh Bore R.B. — Rock Bit C.W. — Core Water C.A. — Core Air S.T. — Shelby Tube F.B. — Finger Bit
DE	РТН		PENETRA	TION RECORD	<u>}</u>	SAMPLE DESCRIPTION
FROM	то	метнор	POCKET PENETRO- METER	NO OF BLOWS	CORE	COLOR-MATERIAL-MOISTURE-CLAY CONSISTENCY
0.0	1.0	WB			!	Top soil
1.0	7.5	WB				Dark brown silty clay, medium to stiff
7.5	12.5	WB				Brown silty clay, medium to soft .
12.5	15.0	WB				Gray clay w/trace very fine sand, & weathered shale
15.0	20.0	WB		·····		Shale, medium to soft
20.0	27.0	WB				Same
27.0	30.0	WB				Gray silty clay, medium to stiff
30.0	35.0	WB		 		Same
35.0	40.0	WB				Same
40.0	43.5	WB				Same
43.5	45.5	W/B		· · · · · · · · · · · · · · · · · · ·		Gray silty clay, medium to soft
45.5	50.0	WB				Gray fine sand, trace medium sand
90.0	55.0	WB				Same
55.0	60.0	WB				Same
60.0	63.0	WB				Gray fine sand, trace very fine sand
63.0	69.0	WB				Gray fine sand, trace medium sand
AKS:	Casing, Water	Loss, Et	xc.)			Water Level Time Date
-				·		(Completion
		·				
kena - I	llanda	^		,		

Tyre-western Companu./nc.

CONSTRUCTION OF WELL



لمتنب اسار	e City A	сту Ап	munition	Plant		Boring No.	B-3		Sheet _ 2_ of _
						Surface Elevation	750.7	Offse	rt
<u></u>						Date Started 2/16	5/82C	ompleted	2/18/82
y & State_1	independer	nce. M	issouri			Driller T. But	ler	Rig	D-1
				Α	bbreviations:	A.O. — Auger Only * H.A. — Hollow Auger W.B. — Wash Bore	S.S S	plit Spoon	C.A Core Au
DEP	тн			TION RECOR	۾ ٥		SAMPLE DE	SCRIPTION	NC
FROM	то	METHOD	POCKET PENETRO- METER	NO OF BLOWS	CORE RECOVERY	COLOR-MAT	ERIAL-MOIS	TURE-CL	AY CONSISTENCY ND DENSITY
74.5	75.5	WB				Light gray lim	shale.	hard	
75.5	77.0	WB				Limestone			<u></u>
77.0	Total De	pth							
	<u> </u>							-	
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									<u> </u>
									
			-						
WARKS: II	Casing, Water	l ar S				<u> </u>			
(L086, E(IC.)			Water Leve			Date 2/18/82(Comple
,						Dry_	10:0	<u> </u>	TT TOTO

Project	ke City Ar	my Amm	unition	Plant		Boring No. R-3 Sheet
) –						Surface Elevation 750.7 Offset
Address			,	 		Date Started 2/16/82 Completed 2/17
City & State	Independ	ence.	Missour		•	Driller T. Butler Rig D-1
				Abb	reviations:	A.O. — Auger Only R.B. — Rock Bit C.W. — H.A. — Hollow Auger S.S. — Split Spoon C.A. — W.B. — Wash Bore S.T. — Shelby Tube F.B.
DE	EPTH		PENETRA	TION RECORD	≥	SAMPLE DESCRIPTION
FROM	то	МЕТНОВ	POCKET PENETRO METER	NO OF BLOWS	CORE RECOVERY	COLOR-MATERIAL-MOISTURE-CLAY CONSIS
0.0	0.5	WB				Topsoil
0.5	8.0	WB				Dark brown silty clay, medium to soft
8.0	13.0	WB				Brown silty clay, soft to medium
13.0	26.5	WB				Gray silty clay, w/trace of weathered trace fine sand, soft to medium
26.5	28.0	WB				Gray clay, trace of fine sand, medium
28.0	34.0	WB				Gray clay, medium to soft
34.0	42.0	WB				Gray clay, medium to stiff
42.0	45.5	WB				Gray fine sand, trace of medium sand
45.5	50.0	WB				Same
50.0	55.0	WB				Same
55.0	60.0	WB			·	Same
60.0	65.0	₩R	<u> </u>			Same
65.0	69.0	WB				Same
69.0	69.5	WB				Limestone
69.5	71.5	WB				Gray shale, medium to hard
71.5	74.5	WB				Light gray limy shale, medium to hard
EMARKS:	(Casing, Water	Loss, Et	tc.)			Weter Level Time Date
						
	///					

-	ROJECT OCAT 101		SUPPLY WELL	DATE	120/41 LAYNE- WESTERN
D	RILL R	IG		BORE HOLE	# (17 A) Page of 3
		SAMPLE			
•	FEET DEPTH		DESCRIPTION		REMARKS
			BLACK SOIL (SCIGHTLY SICTY CLAY) .	ELEV. 741.6' STATIC WATER LEVEL:
	_		YELLOW SAND	y Clay	16.5' PRODUCTION:
	_				438 gpm with

SAND, MEDIUM TO COARSE ARKOSIC

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ROJECT	WATER	SUPPLY WELL	DATE -2	/20/41
CATION			DRILLERS -	LAYNE - WESTER
ILL RI	IG		BORE HOLE	#1 (17 A)
,				Page 2 of 3
	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
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ROJECT DCAT 101	N	DRIL	LERS	
RILL R	16	BORE	HOLE	1 (17A)
				Page 3 of 3
	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
00				
-		COARSE SAND AND GRAVEL	;	
	00000	Few Boulders		
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-	4		•	25'05 18" STAINLET
	000000		1	Steel shurten Screen
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	.		1	6" flub in Bottom:
•	500000	•	i	Top of Plub: 84.5'
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OJECT CATION]		DRILLERS	LAYNE-WESTERN
ILL RI	G		BORE HOLE	#2 (178) Page / of 3
	SAMPLE			
FEET Depth		DESCRIPTION		REMARKS
		BLACIC SOIL (Sughtly Silty Cla	4)	ELEV. 739.1'
,		YELLOW CLAY		STATIC WATER LEVEL
_		•		Production:
				330 gpm
-			,	B 'DRAWDOUN
10				
		FINE SAND		
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		BLUE SANDY CLAY		
zo		2.00		
		· FINE SAND	ì	
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OJECT CAT 10		Supply Well	DATE 4	LAYNE - WESTERN
RILL RIG		BORE HOLE	#2(17B)	
				Page 2 of 3
	SAMPLE			
FEET		DESCRIPTION		REMARKS
		FINE TO MEDIUM	SAND	
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	00000	CDARSE SAND	74-b	
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CATION		·	DKIFFER?	LAYNE- WESTERN
ILL RI	16		BORE HOLE	#2 (178)
				Page 3 of 3
	SAMPLE			
FEET DEPTH		DESCRIPTION		Remarks
	* • • • • •			
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10		•		•
				251 12
				25 OF 18 STAINLES
				STEEL SHUTTER SCREE
:				12" PLUG IN BOTTOM:
				Top of Plu6: 79.9'
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TD -		TOP OF PLEASAUTON S		
J. Q_		lop of Pleasauton S	+	
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	1 1		•	

RILL RIG BORE HOLE SAMPLE Page 1 of 3 Page 1 of 3 Page 1 of 3 REMARKS BLACK SOIL (SLIGHTLY SILTY CLAY) BROWN CLAY STATIC WATER LEVEL 17.4' PRODUCTION: 421 9pm 6' drawdown SOFT YELLOW CLAY					
DESCRIPTION REMARKS BLACK SOIL (SLIGHTLY SILTY CLAY) BROWN CLAY TATIC WATER LEVEL 17.4' PRODUCTION: 421 9pm 6' drawdown FINE SAND	RILL R	IG —		BORE HOLE	
DESCRIPTION BLACK SOIL (SHIGHTLY SILTY CLAY) BROWN CLAY TATIC WATER LEVEL 17.4' PRODUCTION: 421 9pm 6' drawdown EINE SAND		Paris a P			Page / of 3
DEPTH BLACK SOIL (SLIGHTLY SILTY CLAY) BROWN CLAY BROWN CLAY FINE SAND DESCRIPTION REPARKS REPARKS ELEV. 744.7 STATIC WATER LEVEL 17.4' PRODUCTION: 421 gpm 6' drawdown ELEV. 744.7 FINE SAND		SAMFLE			
BLACK SOIL (SLIGHTLY SILTY CLAY) BROWN CLAY STATIC WATER LEVEL 17.4' PRODUCTION: 421 9pm 6' drawdown FINE SAND	FEET DEPTH		DESCRIPTION		REMARKS
BROWN CLAY STATIC WATER LEVEL 17.4' PRODUCTION: 421 9pm 6' drawdown FINE SAND					ELEV. 744.7
17.4' PRODUCTION: 421 9PM 6' drawdown FINE SAND	_			1)	1'
SANDY CLAY 6' drawdown FINE SAND	-		טונסשט ברשך		3
SANDY CLAY 6' drawdown FINE SAND			•		PRODUCTION:
SANDY CLAY 6' drawdown FINE SAND	_				£
FINE SAND	-			<u></u>	I
FINE SAND	10		SADAY CLAY		- 3.3333
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SOFT YELLOW CLAY	<u></u>	-			
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FINE SAND

PROJECT WATER SUPPLY WELL LOCATION ————————————————————————————————————			DATE 4/30/41 DRILLERS LAYNE-WESTERN	
			BORE HOLE	#3 (17C) Page 2 of 3
FEET DEPTH	SAMFLE	DESCRIPTION		Remarks
\$ 1 1 1 1 1		BLUE CLAY CORRESOND ÉLIC	CAITE	
		COARSE SAND É LIC	SHITE	

CAT IO		DATE - DRILLERS	LAYNE-Westerni
ILL R	16 —	BORE HOL	E #3 (/7C) Page 3 of 3
•	SAMPLE		1
FEET DEPTH		DESCRIPTION	REMARKS
_		·	
_		•	
- 70		COARSE SAND & GRAVEL	1
-	0 9 0 0 0	CORNER SHAPE	
-	00000		
		SOFT BLUE CLAY	25' OF 18" STAINLE STEEL SHUTTER SCRE
30 <u></u> -	000000	COMESE SAND & GRAVEL	Top of Plus: 89'
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	00000		
10 Tb —		PLEASANTON SH	<u> </u>

RILL R	16 —	BORE	HOLE #4 (170) Page / of 4
FEET DEPTH	SAMFLE	DESCRIPTION	REMARKS
10-		SOIL (SLIGHTLY SILTY CLAY) SANDY CLAY DRY SAND	ELEV. 745.3' STATIC WATER LEVE 16.3' PRODUCTION: 368 gpm 8' DRAWDOWN
20——		FINE SAND	

BLUE CLAY

RILL R	IG		BORE HOLE	#4 (170)
		BOKE HOLL		Page Z of 4
	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
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-		COARSE TO MEDIUM	SAND	
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•		FINE SAND		
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		· COARSE SAND & GO	RAJEL	
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	PROJECT WATER SUPPLY WELL LOCATION DRILL RIG			LAWE-WESTERN
DRILL R				#4 (170) Page 3 of 4
	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
~	000000			
		FINE SAND		
		COARSE SAND		
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-		· FINE SAND		
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PROJECT WATER SUPPLY WELL DEATION		DATE DRILLERS	LAYNE-WESTERN	
ILL R	1G		BORE HOLE	
	SAMPLE			Page 4of 4
FEET DEPTH		DESCRIPTION		Remarks
90				
_	000000	COAKSE SAND & GR	AUEL	25' OF 18" STAINLES
				STEEL SHUTTER SCREE
	220000			10" PLUE IN EOMONI
				Top of Penc: 97.3'
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DRILL RIG BORE HOLE FEET DESCRIPTION REMARKS SOIL BLUE CLAY TRODUCTION: 427 9pm 6' DRAWDON	Wesner
DESCRIPTION REMARKS SOIL BLUE CLAY STATIC WATER 12.9' PRODUCTION: 427 9pm 6' DRAWDOO	
DEPTH DESCRIPTION SOIL BLUE CLAY STATIC WATER 12.9' PRODUCTION: 427 9PM 6' DRAWDOO	
STATIC WATER 12.9' PRODUCTION: 427 gpm 6' DRAWDOO	MARKS
20-	IATER LEVEL: ON:

P	ROJECT	WATER	5/23/41		
	OCAT 10			DRILLERS	5/23/41 LAYNE-WESTERN
D	RILL R	16		BORE HOLE	#5(17E)
					Page 2 of 3
		SAIAFLE			
•	FEET DEPTH		DESCRIPTION		Remarks
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	_		CLAY		
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ROJECT DCAT 10		SUPAY WELL	DATE -S	LAYNE-U STERN
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	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
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	NATER SUPPLY WELL	DATE	LAYNE - UESTERN
DRILL RIG		BORE HOLE	¥7 (17G)
D E. 1.10		50 11.2 11025	Page 1 05 7

}	SAMPLE		
FEET DEPTH		DESCRIPTION	Remarks
		BLACK SOIL (Slightly Silty Clay)	ELEV. 737.0'
j		BROWN CLAM	STATIC WATER LEVEL:
_		•	9.0'.
-			PRODUCTION:
-			348 дри
10			10.5' DRAWDOWN
_		FINE SAND	
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CATION — Supply WELL			DRILLERS	LAYNE-WESTERN
ILL RI	6 -		BORE HOLE	#7(176)
				Page 2of 3
	SAMPLE			
FEET EPTH		DESCRIPTION		REMARKS
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PROJECT LOCATION		Supply West	DATE	LAYNE WESTERN		
DRILL R	RILL RIG			BORE HOLE #7 (176) Page 3 of 3		
FEET DEPTH	SAMFLE	DESCRIPTION		REMARKS		
70	000000	COARSE SAND AND	GRAVEL	25'OF 18" STAINLESS STEEL SHUTTER SCREEN 14" PLUGIN BOTTOM TOP OF RUG: 78.2'		
-						

PROJECT LOCAT 10	PROJECT WATER SUPPLY WELL OCATION ORILL RIG			DATE 10/15/42 DRILLERS		
DRILL R				#8 (17 M) Page 1 of 3		
	SAMPLE					
FEET DEPTH		DESCRIPTION		REMARKS		
20		HARD BLUE CLAY		ELEV. 741.5' STATIC WATER LEVEL: 16.0' PRODUCTION: 350 GPM 22' BRANDOWN		
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PROJECT WATER SUPPLY WELL LOCATION	
DRILL RIG -	BORE HOLE #8 (/7M)
	Page 2 of 3
SAMF LE FEET	·

	SAMPLE		
FEET DEPTH		DESCRIPTION	REMARKS
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ROJECT WATER JUPE, WELL DOCATION —			DRILLERS .	
RILL R	IG		BORE HOLE	#8 (17M)
				Page J of 3
	SAMPLE			
FEET DEPTH		DESCRIPTION		REMARKS
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			i	STEEL SHUTTER SCREEN
80	-		1	10' Rus in Bottom
			į	TOP OF RUG: 85.5"
-	1	- VERY FINE SAND		10 P DF ILUS : 83.3
	····	AFIER LINE ZUND	į	
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TD 86.5		TOPOF PLEASANTON SH	1	•

	WATER SUPPLY WELL		10/30/42 LATNE-WESTERN
DRILL RIG		BORE HOLE	#10 (17 k) Page / of 3

	SAMF LE		
FEET DEPTH		DESCRIPTION	REMARKS
		(Scignor Samor CLAY)	ELEV. 740.0'
_		. BLACK CLAY	. ELEV. 170.0
1	 		STATIC WATER LEVEL:
-			20.0'
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		<u> </u>	PRODUCTION:
_		Smor Clay	350 дрм
1			20'DRAWDOWN
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ROJECT OCAT 10	,	DATE DRILL		LAYNE - WESTERN
RILL R	RIG	BORE	HOLE	# 10 (17 K) Page Zof 3
FEET	SAMPLE		$\neg \top$	
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ROJECT OCAT 101			DATE 10/50/42 DRILLERS LOYNE-WASTER		
RILL R	.16 —	Bor	DRE HOLE #10 (171K)		
	SAMPLE		PageS of 3		
FEET DEPTH		DESCRIPTION	REMARKS		
60		FINE SAND			
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_	<u> </u>				
70		COARSE SAND, GRAVEL,			
	00000	FEW SMALL BOULDERS			
<u>-</u>			25" OF 18" STAINLESS STEEL SHUFTER SCREE		
_	000000	·	10" PUG IN 30770~		
80			TOP OF Rus: 86'		
_	000000	•			
TD 87'		TOP OF REASANTON SH			
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PROJECT WATER SUPPLY WELL LOCATION	DATE 5/11/41 DRILLERS LAYNE-Western	
DRILL RIG	BORE HOLE #6 (17F) Page / of 3	-

		SAMPLE		
•	FEET DEPTH		DESCRIPTION	REMARKS
			BLACK SOIL (SCIGHTLY SICTY EC4Y) GRAY CLAY	ELEV. 734.6' STATIC WATER LEVEC: 9.0'
:	[0			PRODUCTION: 348 gpm 18' DRAWDOWN
	1 1 1.		SOFT BLUE CLAY	
	20		FINE SAND	
	30			

PROJE(R SUPPLY WELL	DATE DRILLERS	5/11/41 LAYNE-WESTERN	ZW
DRILL	RIG —		BORE HOLE	#G (17F) Page 20f3	
FEET	SAMPLE	DESCRIPTION		REMARKS	
40		SOFT BLUE CLAY FINE BLUE SAND COARSE SAND	E SAND		
10		SOFT BLUE CLAY	,	·	_

PROJECT LOCATION	WATER SUPPLY WELL	DATE	LAYNE-WESTERN
DRILL RIG		BORE HOLE	#6 (17F) Page 3 of 3
	SAMP LE		

	SAMPLE		
FEET DEPTH		DESCRIPTION	REMARKS
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_		FINE SAND].
			
		COARSE SAND	1
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70			
		•	25 OF 18" STAINLESS
}			STEEL SHUTTER SCREEN
			10" PLUGIN BOTTOM
			TOP OF PLUG: 82.2'
	• • • • •		
-			
		COARSE SAND, GRAVEL.	
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	أدددمة	ODUC BETES	
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83.5		TOP OF PLEASANTON SH	
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ROJECT WATER	2 Supply WELL	DATE 10/18/42	
OCATION		DRILLERS	LAYNE- WESTERN
RILL RIG		BORE HOLE	#9 (17J) Page 1 of 3
FEET DEPTH	DESCRIPTION		REMARKS
	BLACK CLAY		ELEV. 744.0'
	•		STATIC WATER LEVEL
			16.0'
			PRODUCTION:
		l	350 gpm
		1	18' DRAWBOWN
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	BROWN CLMY		•
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CAT 101	٧		DRILLERS.	HAYNE-UKSTERN
ILL RIG			BORE HOLE	#9 (17J)
				Page 2 of 3
	SAMF LE			
FEET EPTH		DESCRIPTION		Remarks
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		FINE SAUD WITH STR	EAKS OF CLAY	
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COAYLSE TO MEDIUM SAND

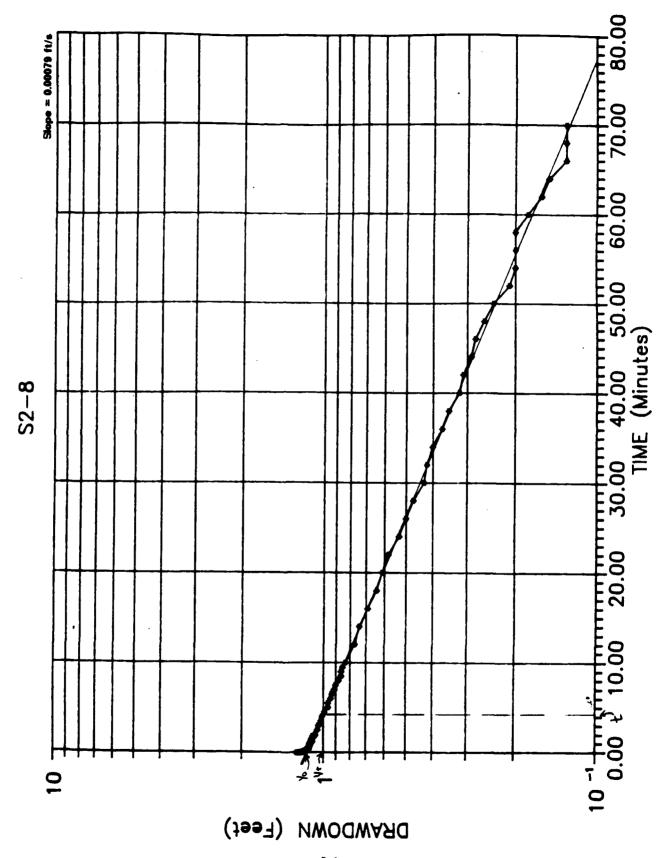
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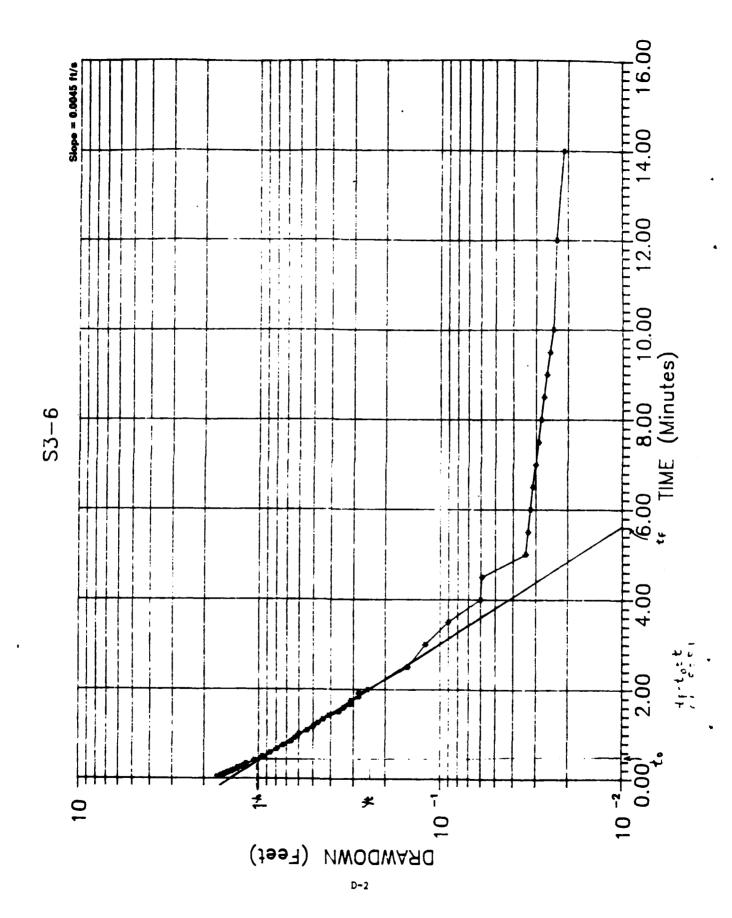
PROJECT WATER SUPPLY WILL LOCATION	DRILLERS LAYNE WESTERN
DRILL RIG	BORE HOLE #9 (173)

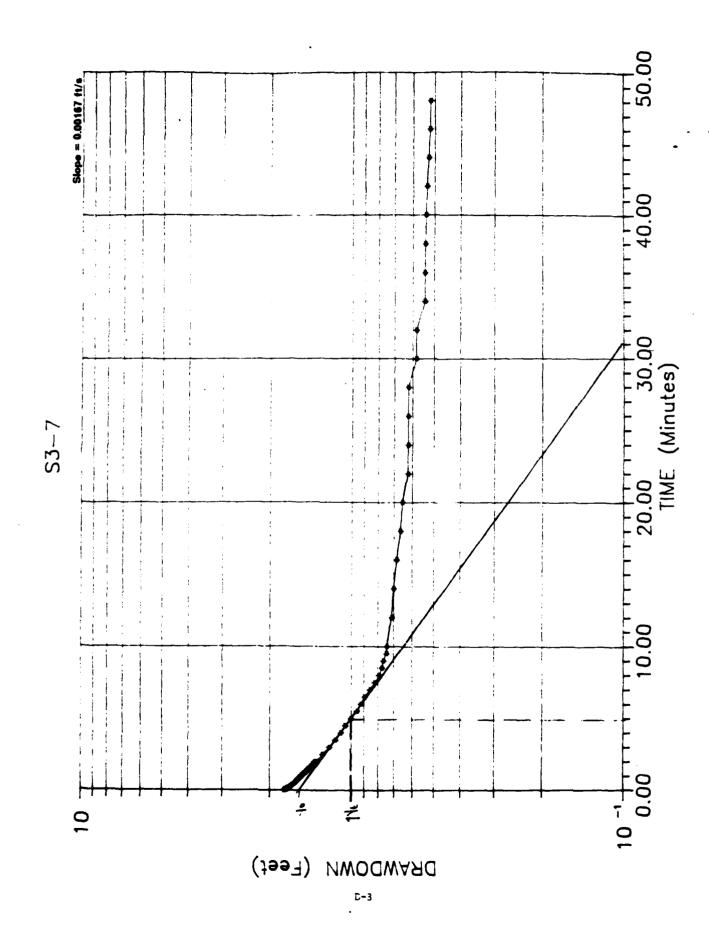
	SAMPLE		
FEET DEPTH		DESCRIPTION	REMARKS
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	1		25 OF 18" STAINLESS
	!	•	STEEL SHUTTER SCROWN
	· · ·		10 " PLUG IN BOTTOM
TD-84.0		TOP OF PLEASANTON SH	Top of Paus: 83.2'
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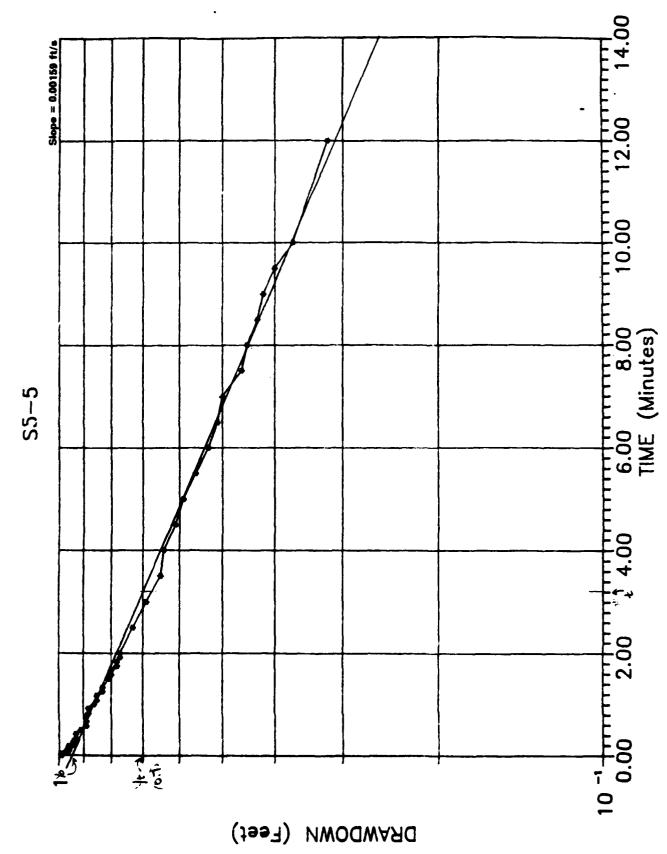
APPENDIX D GEOTECHNICAL DATA



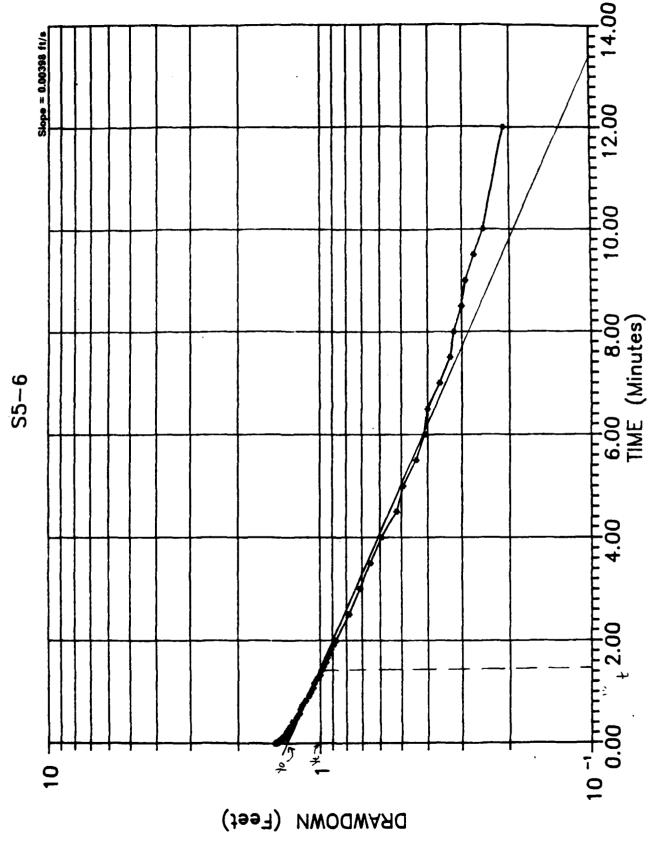


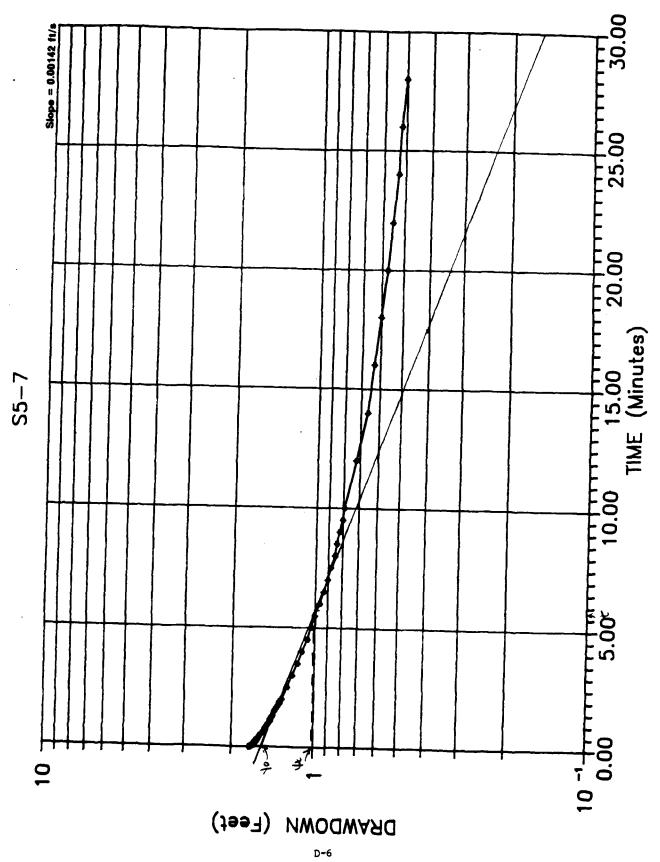




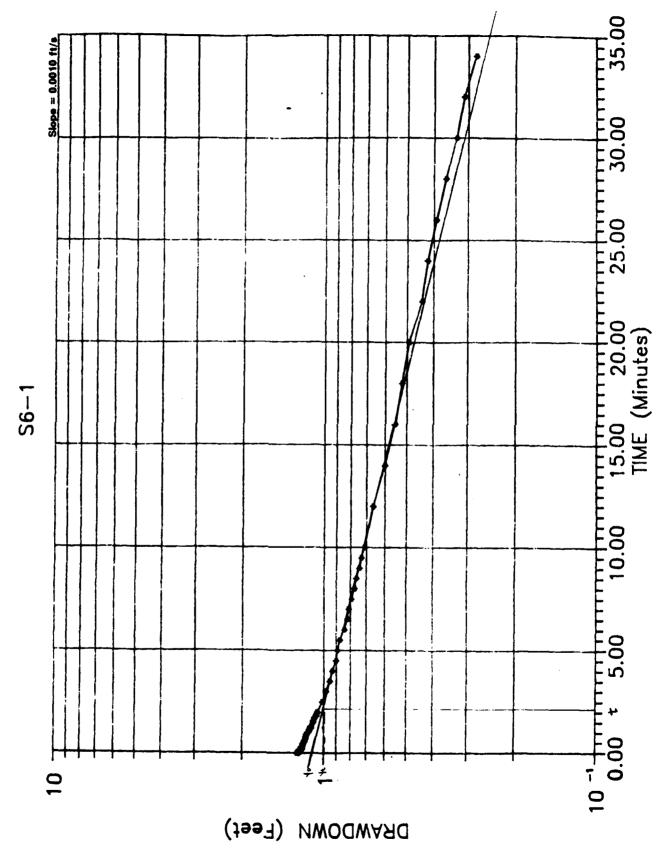


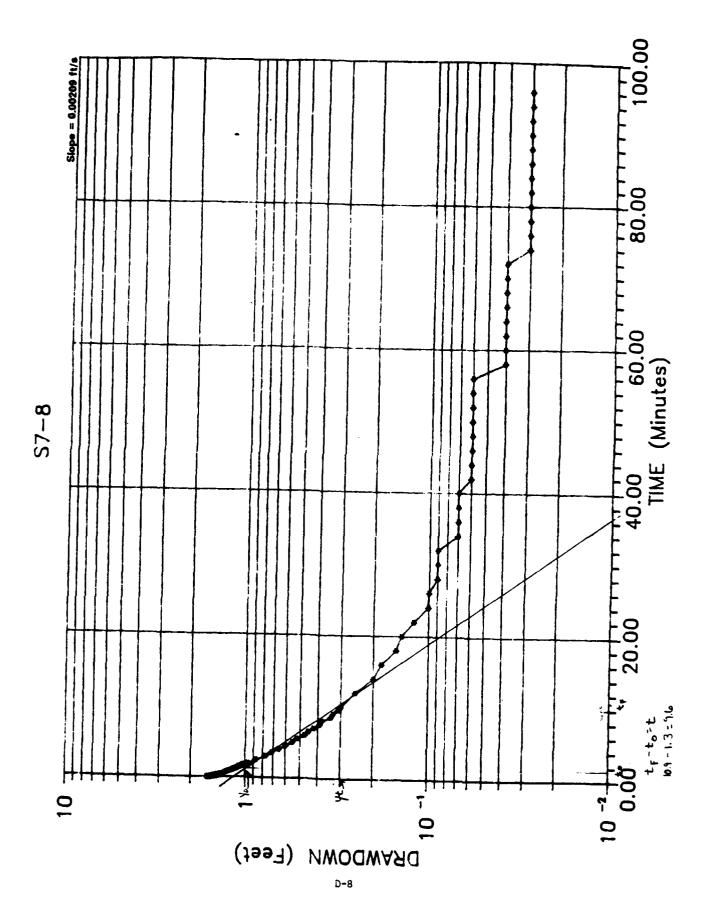




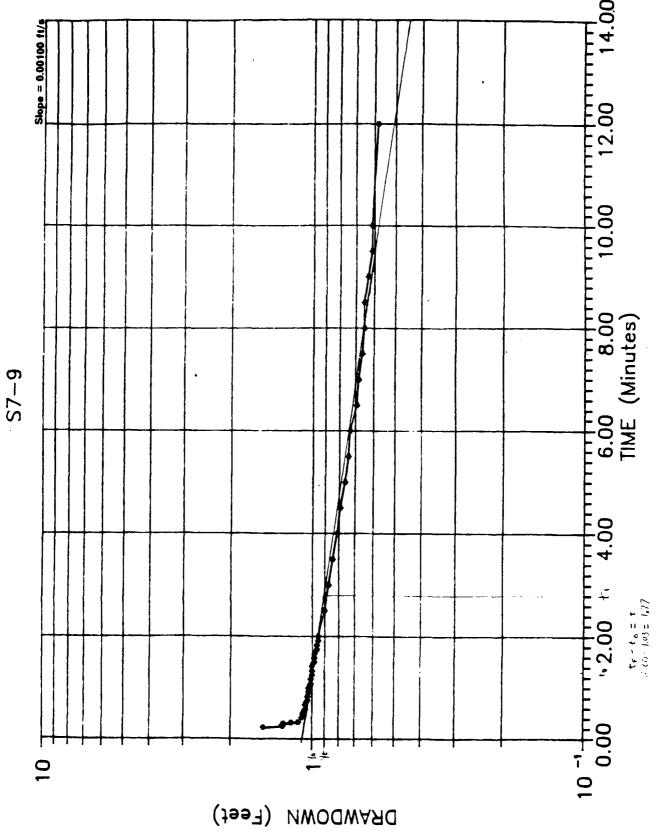


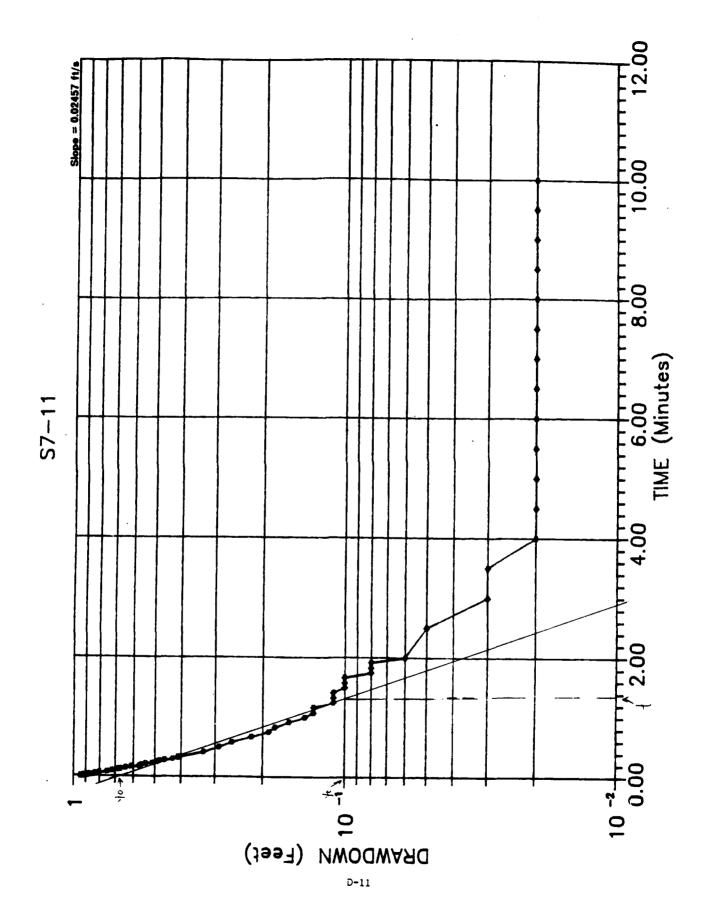


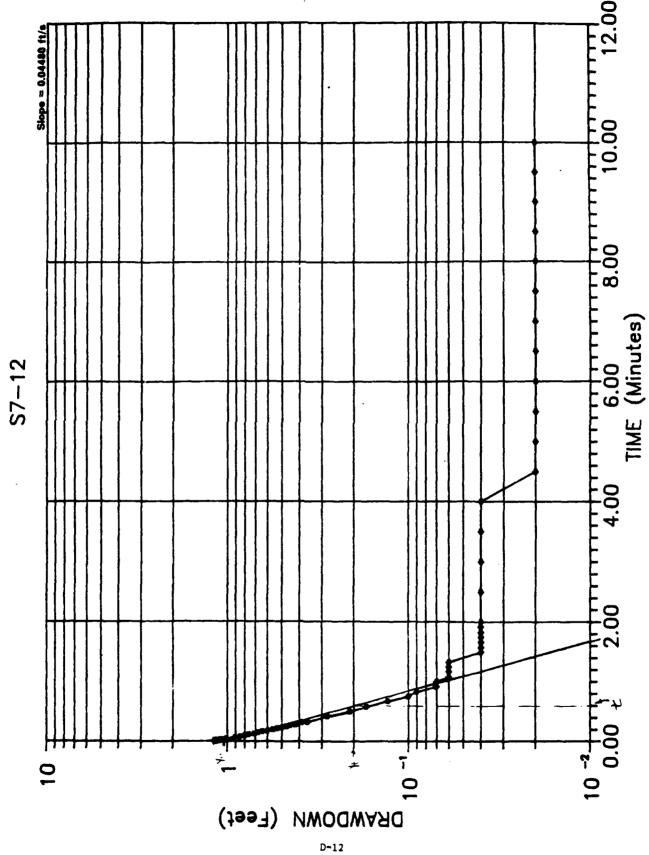


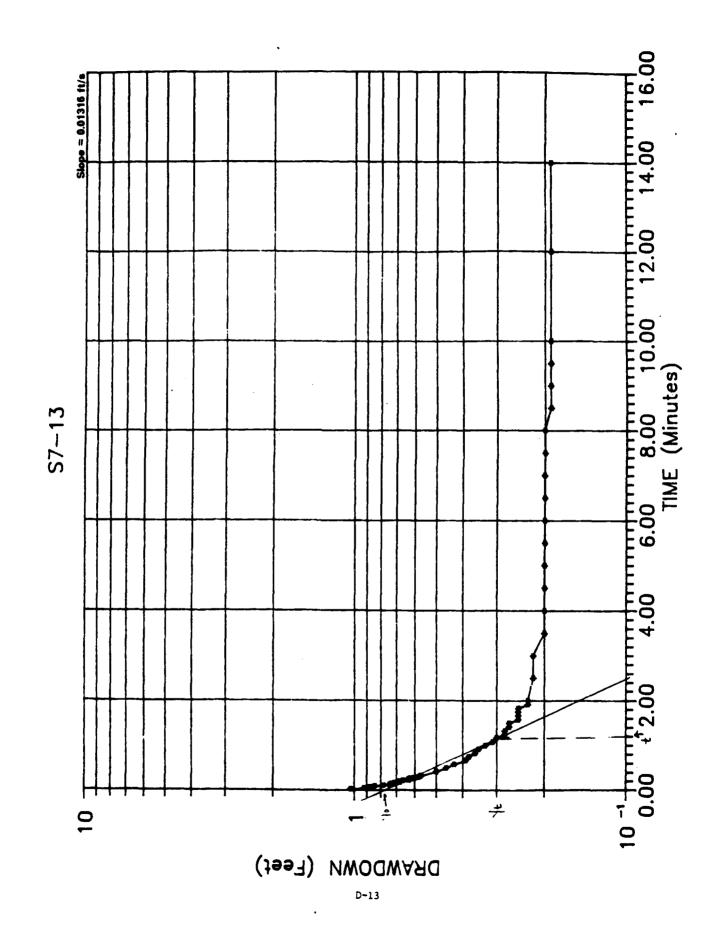


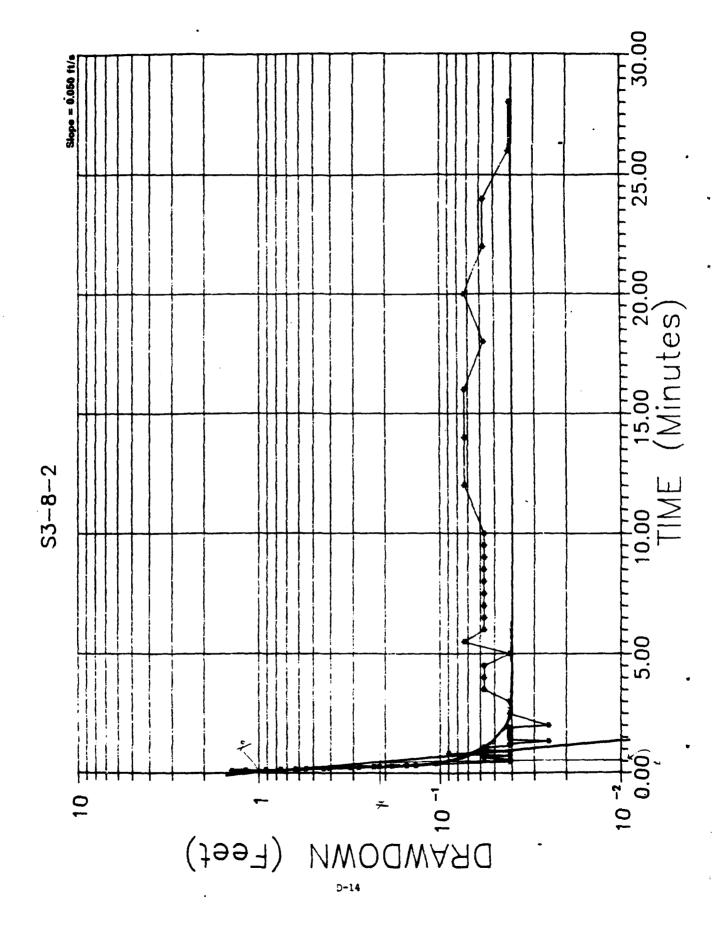


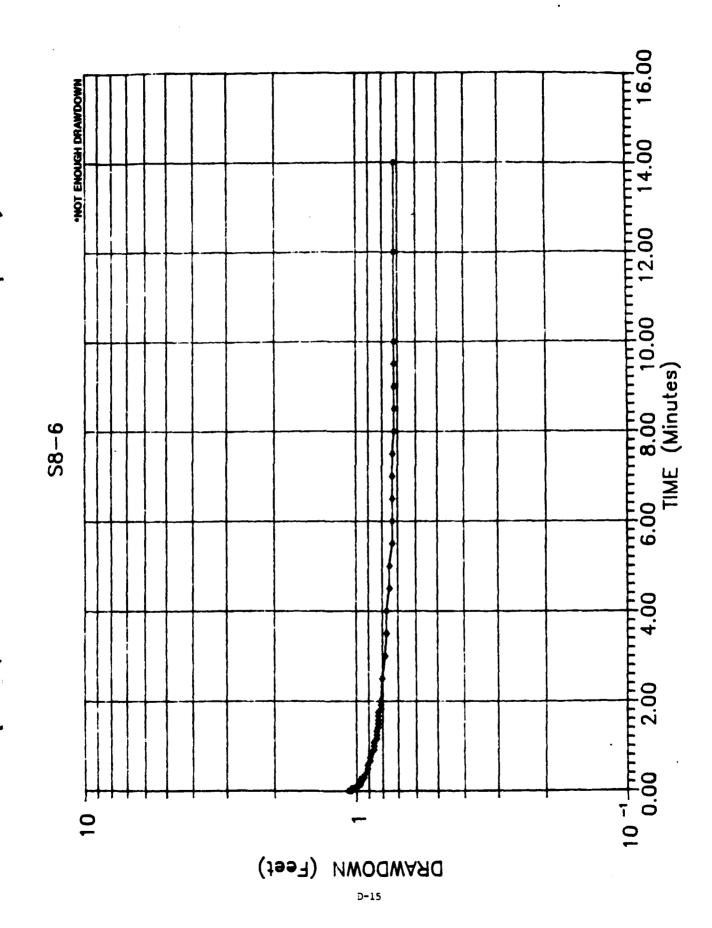


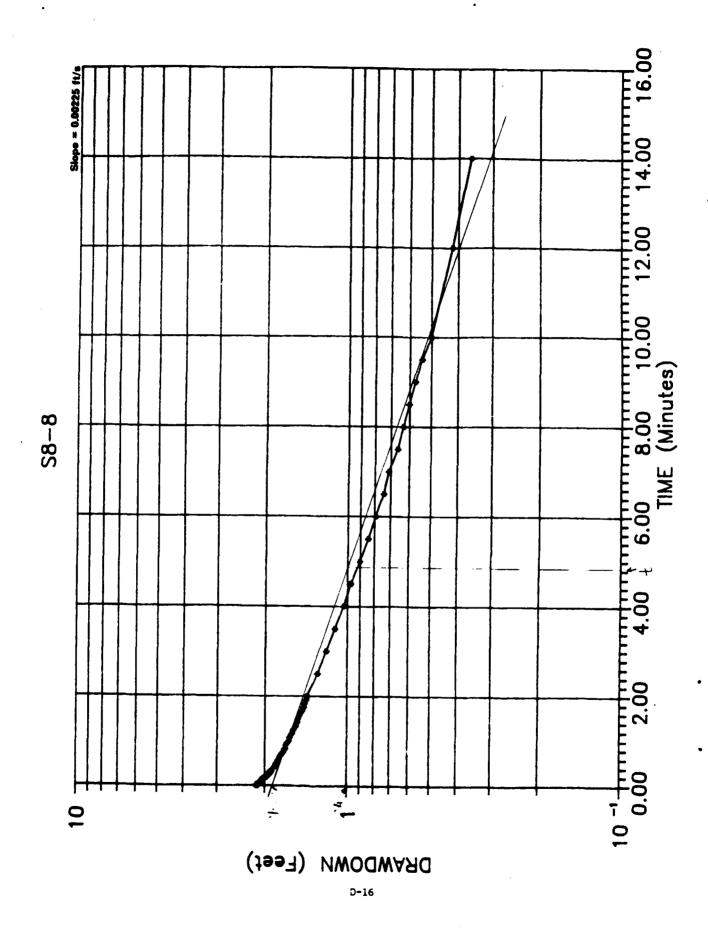


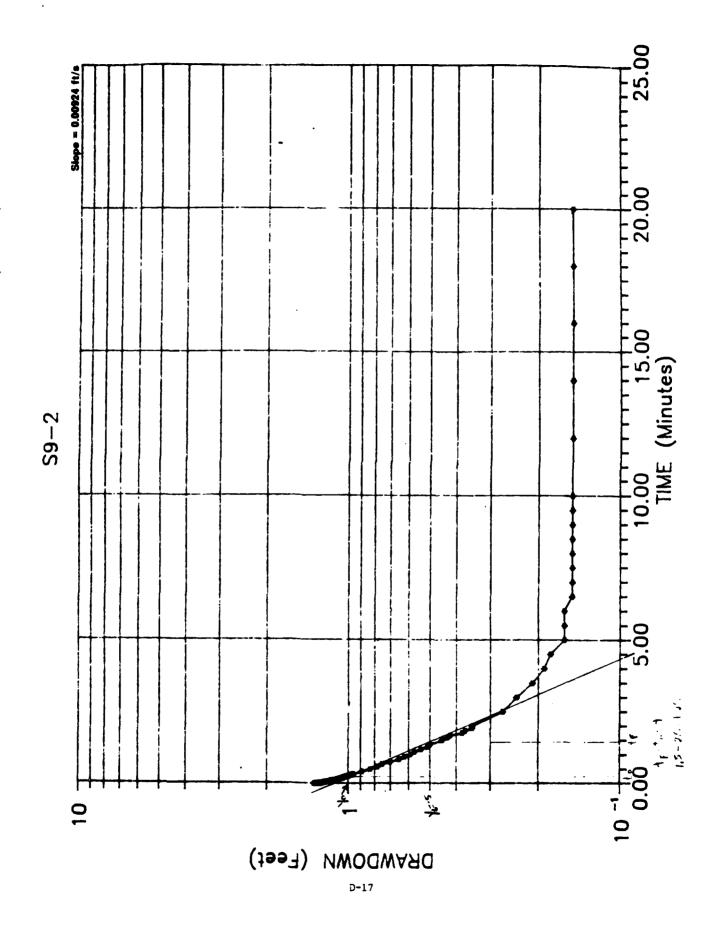




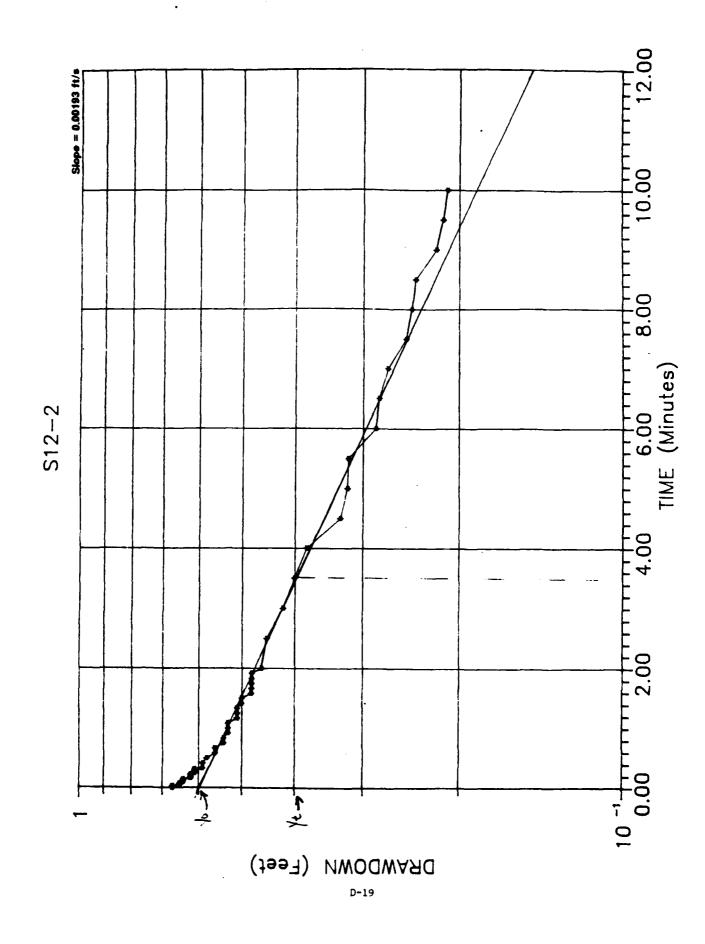


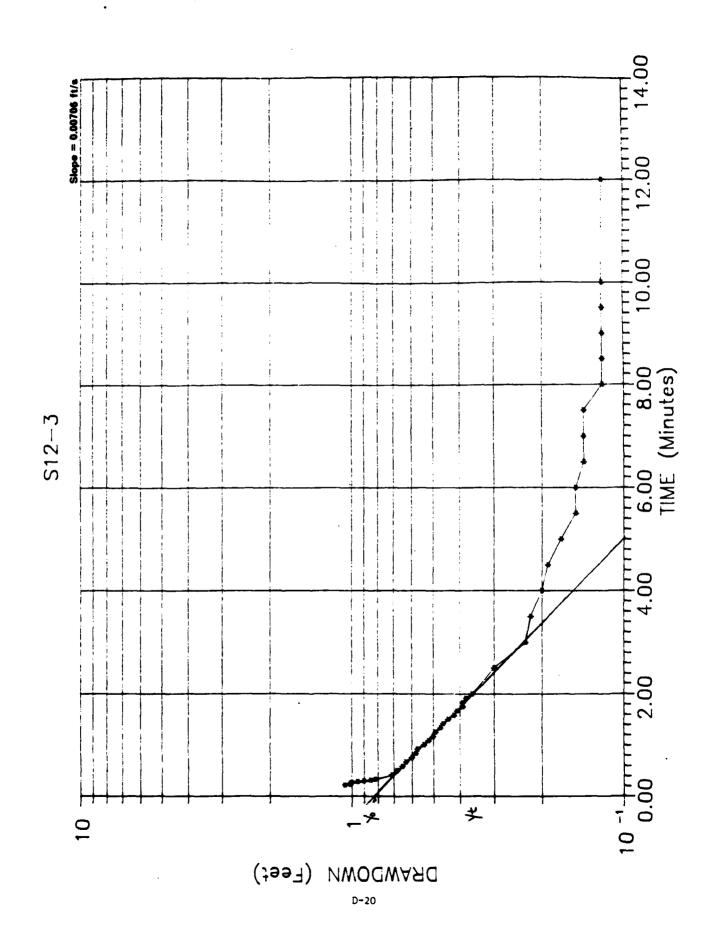




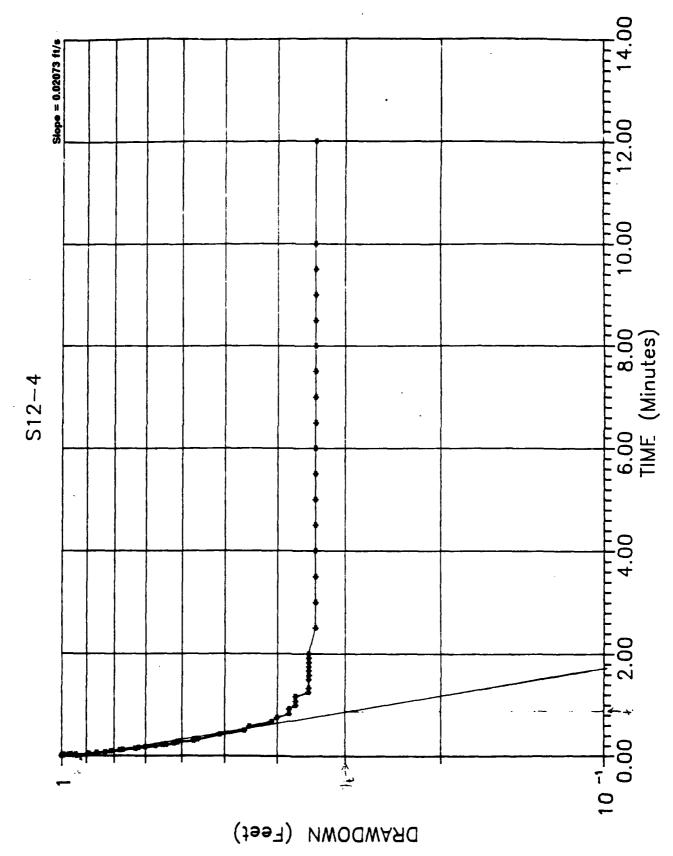


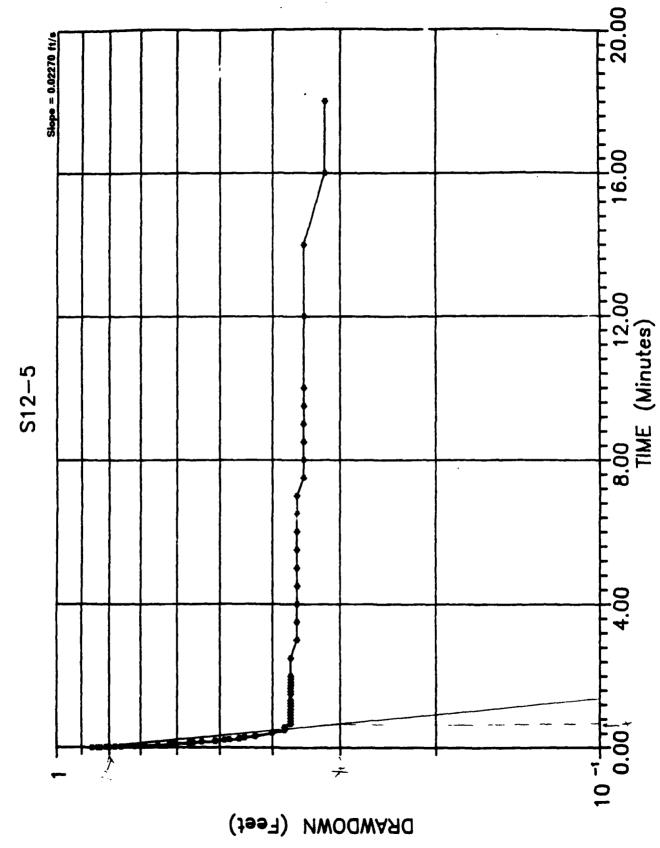
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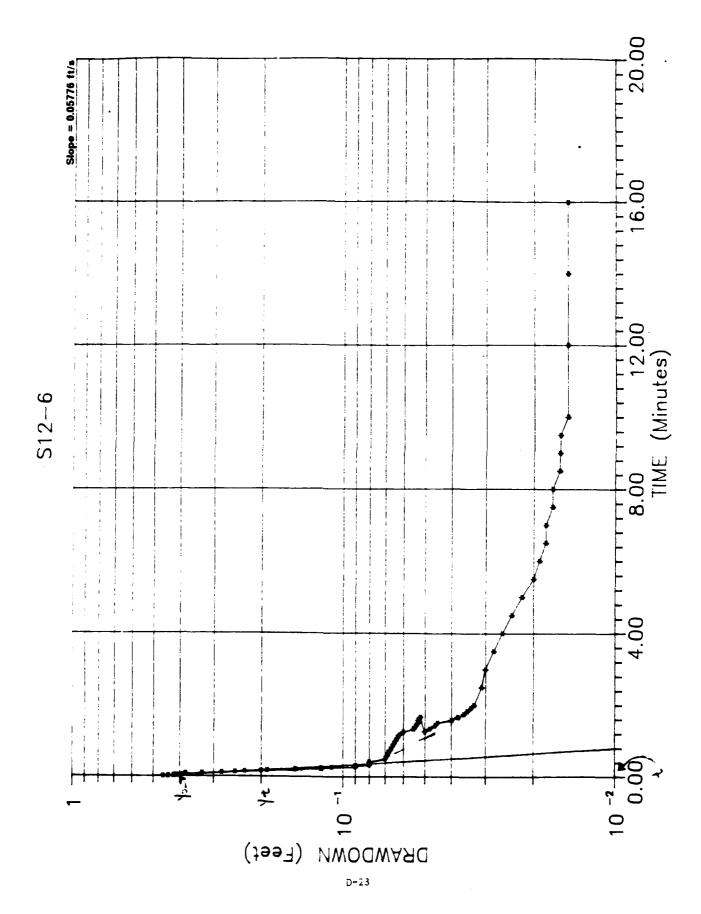


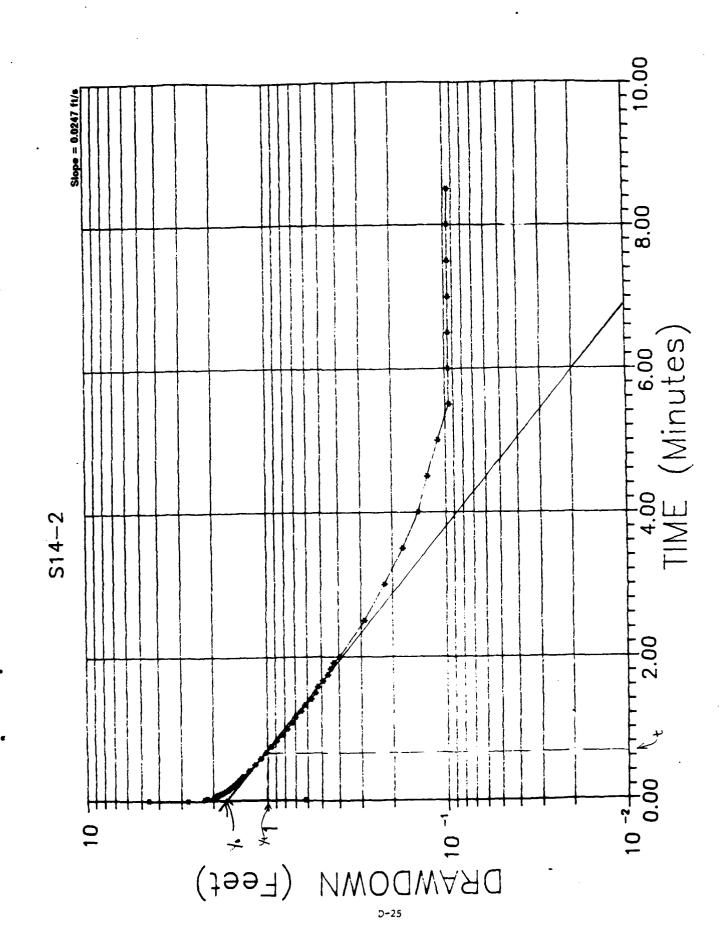


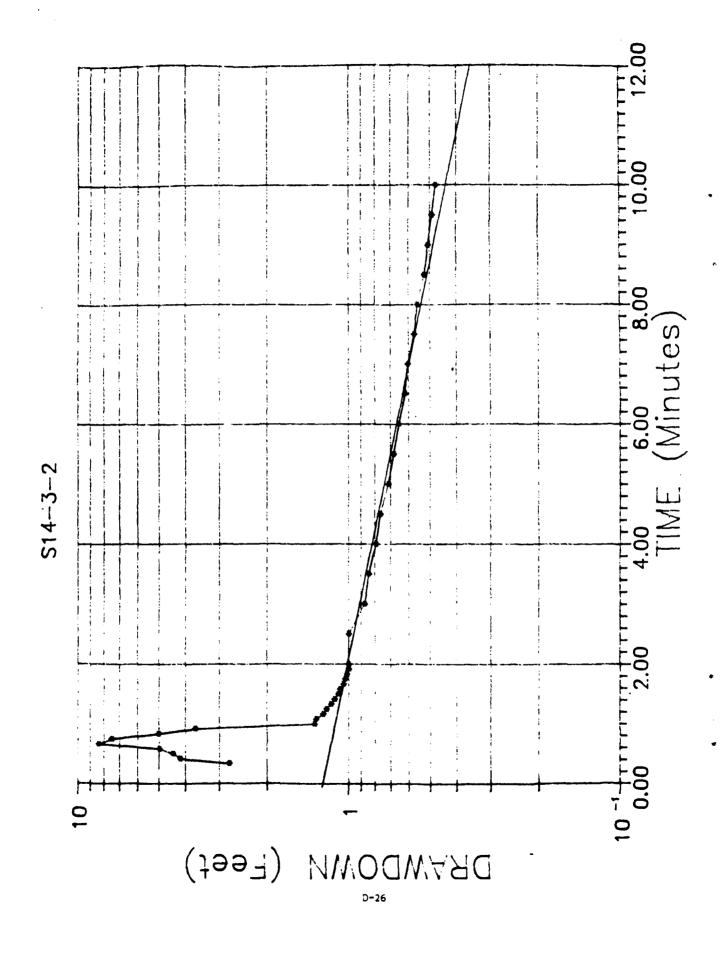


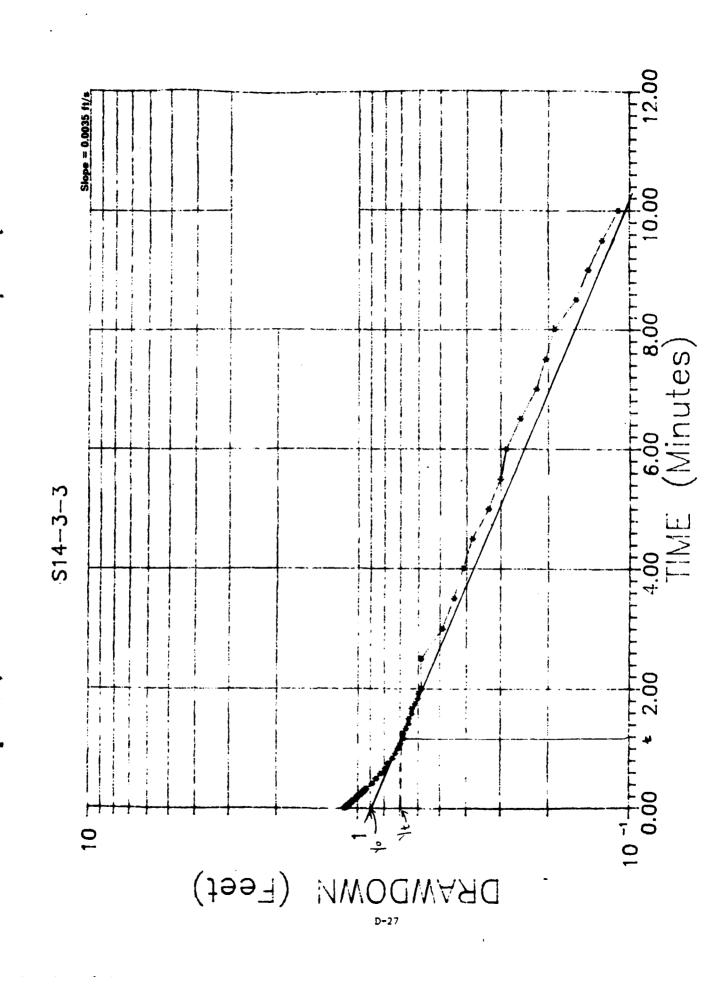


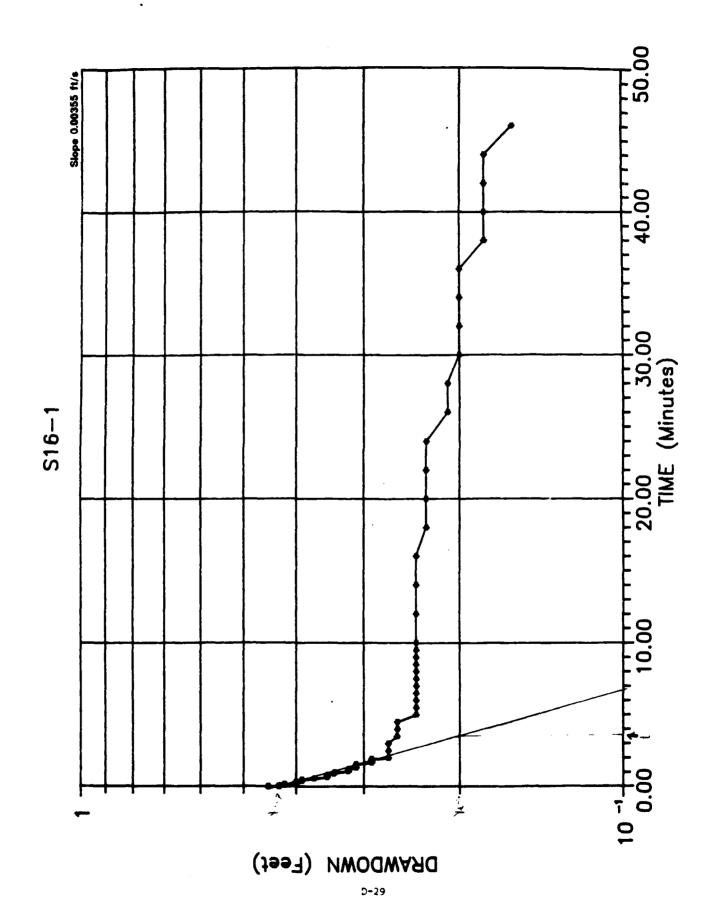


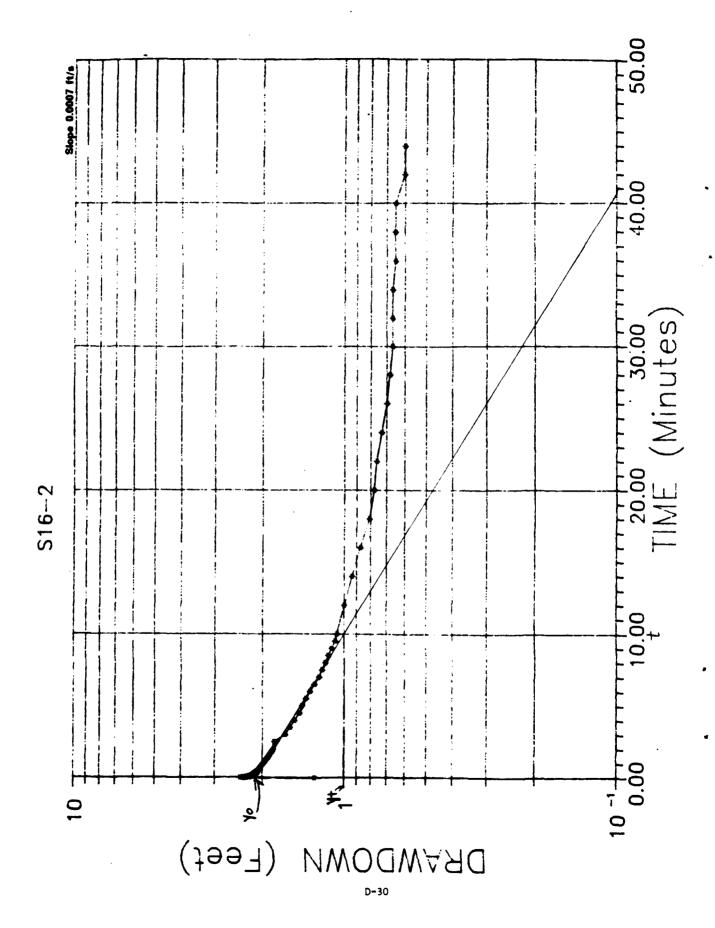




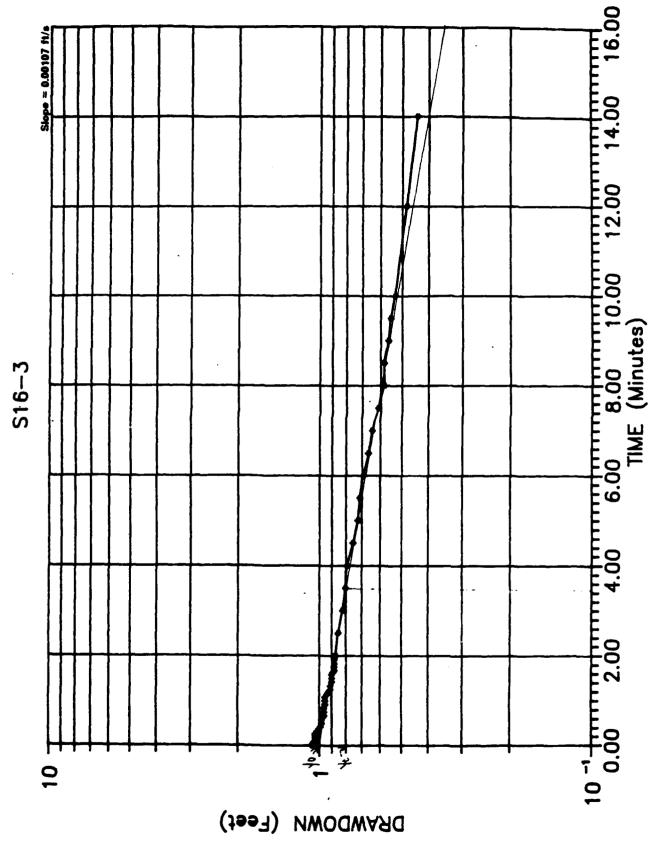


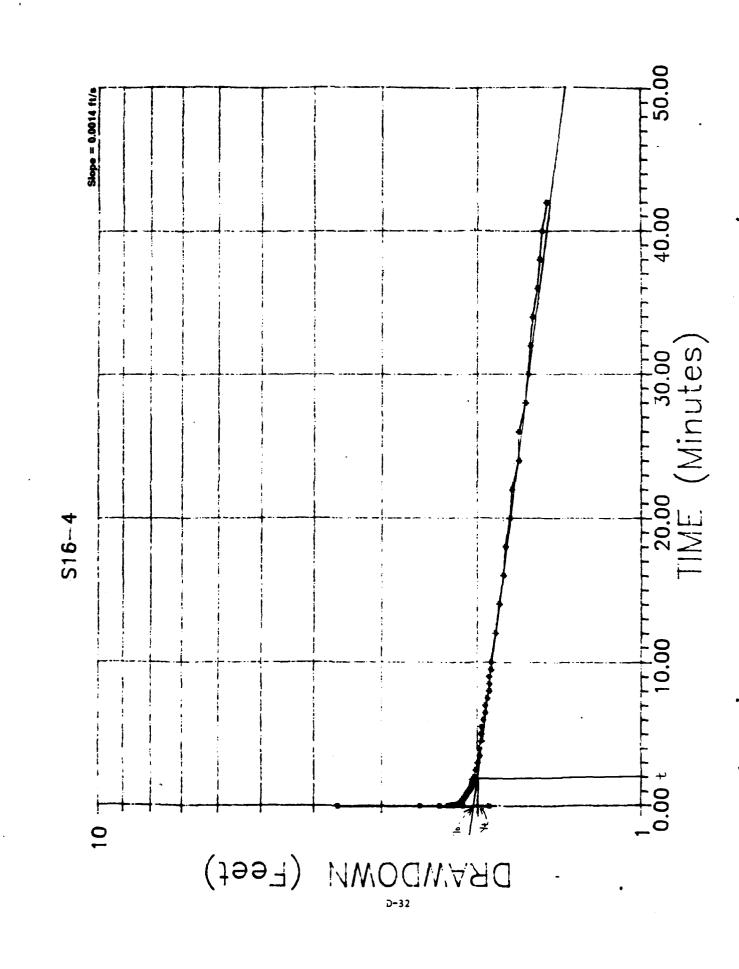


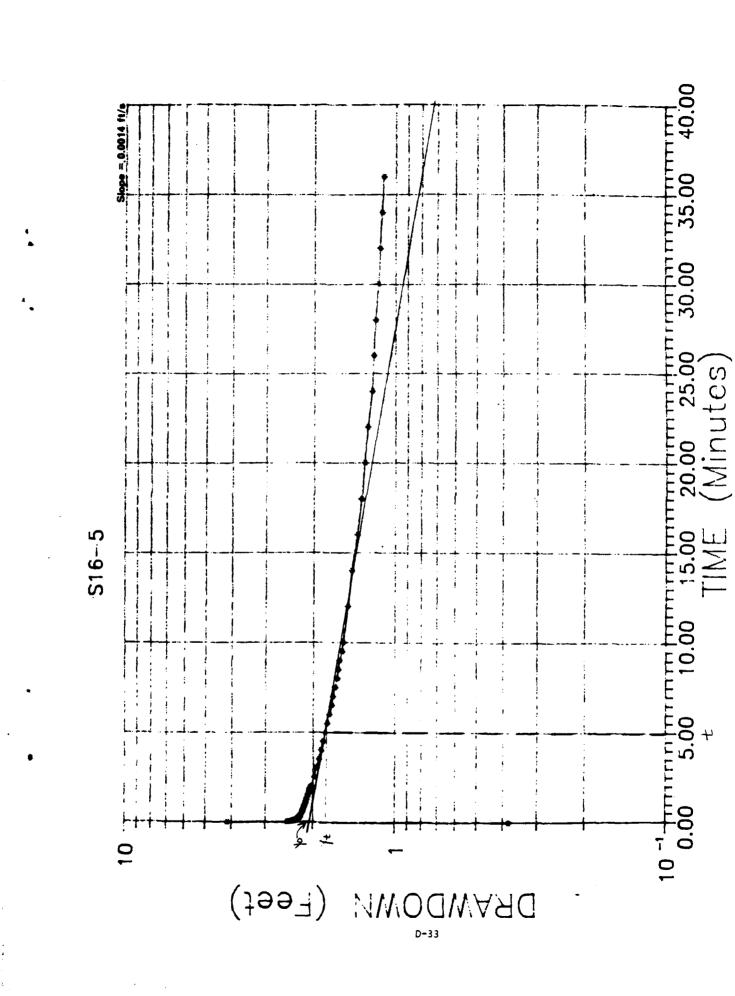


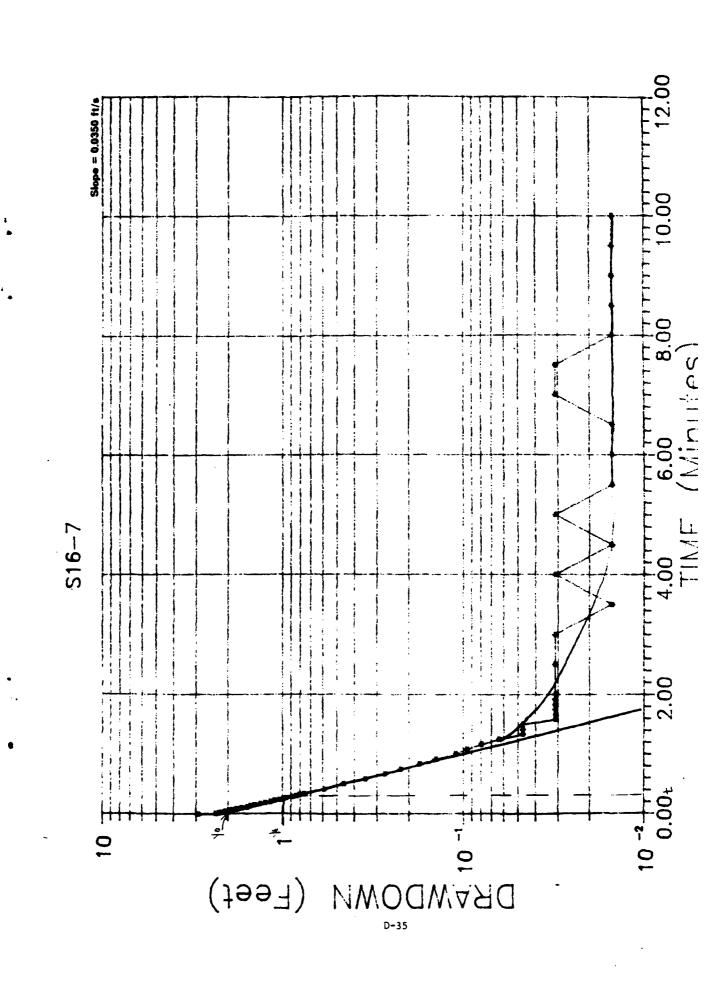


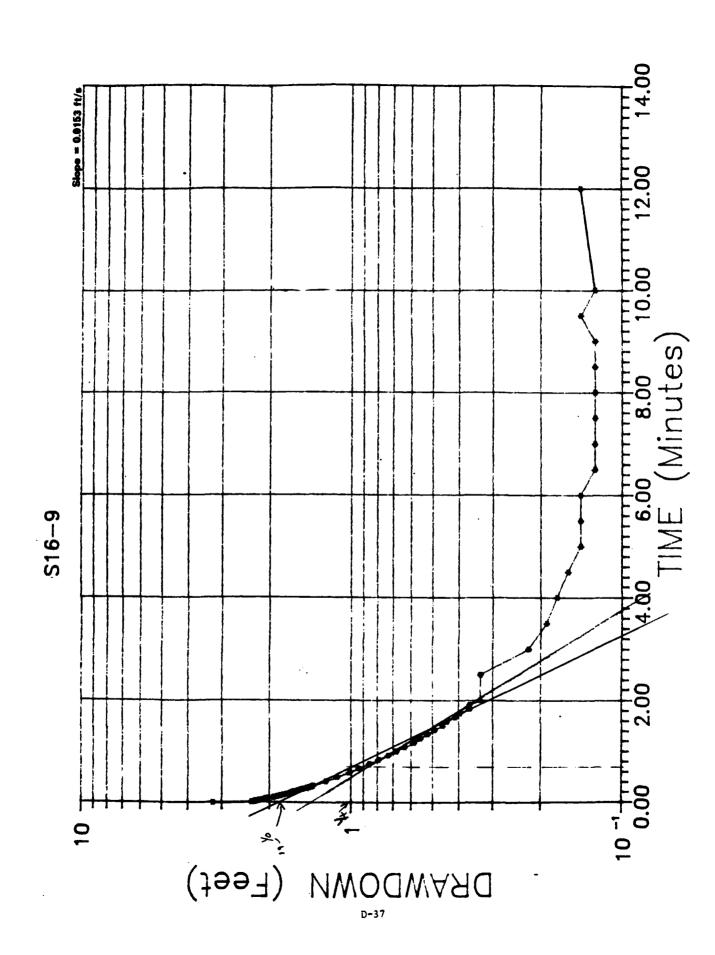


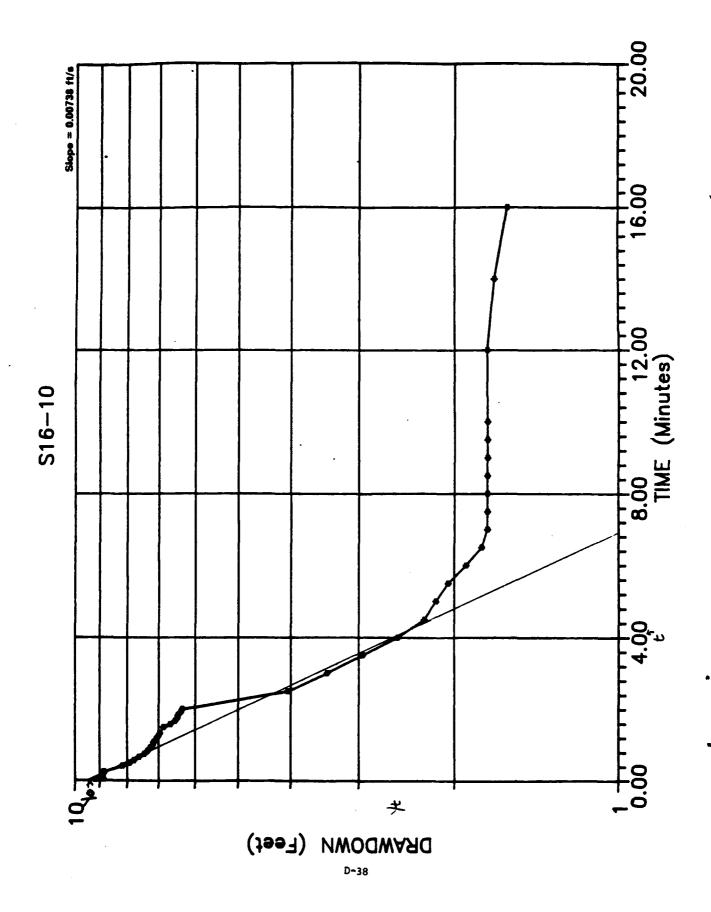


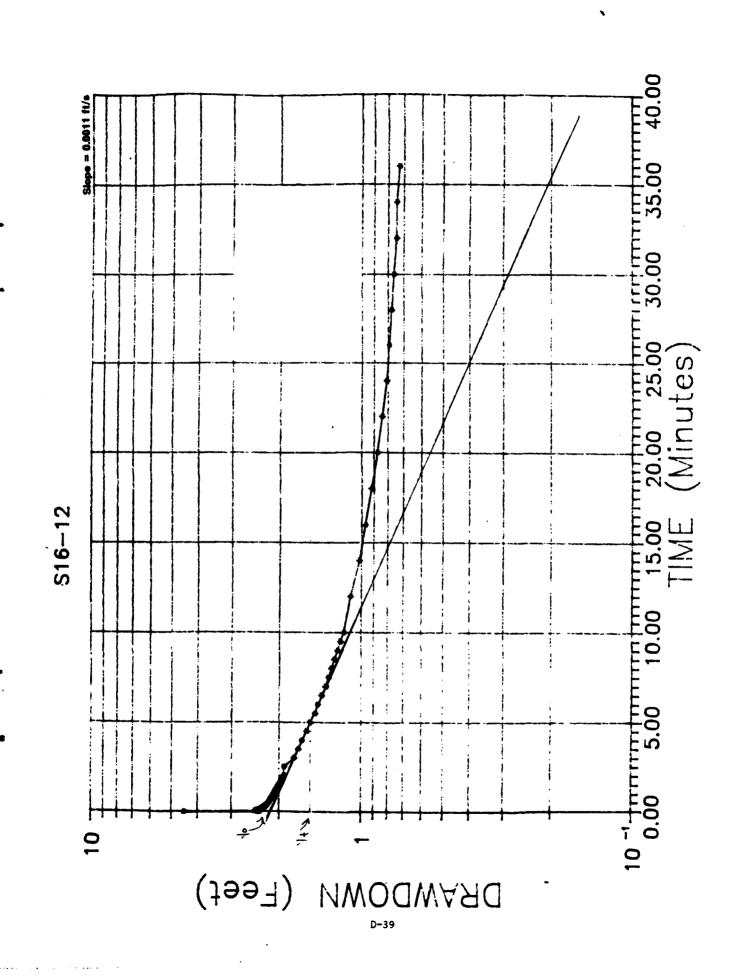


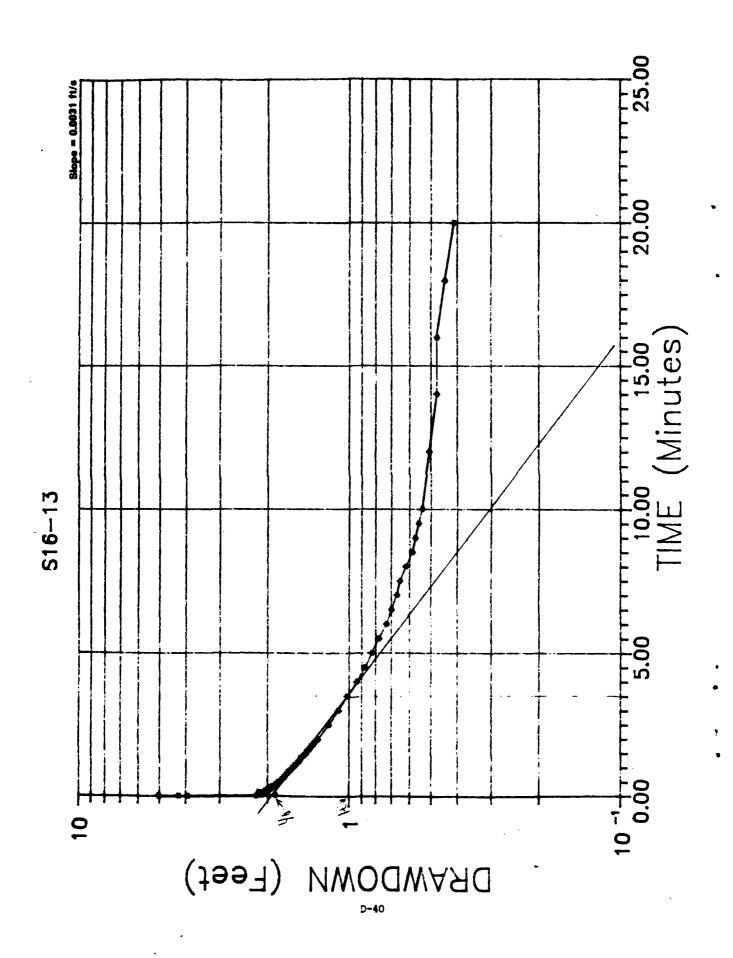


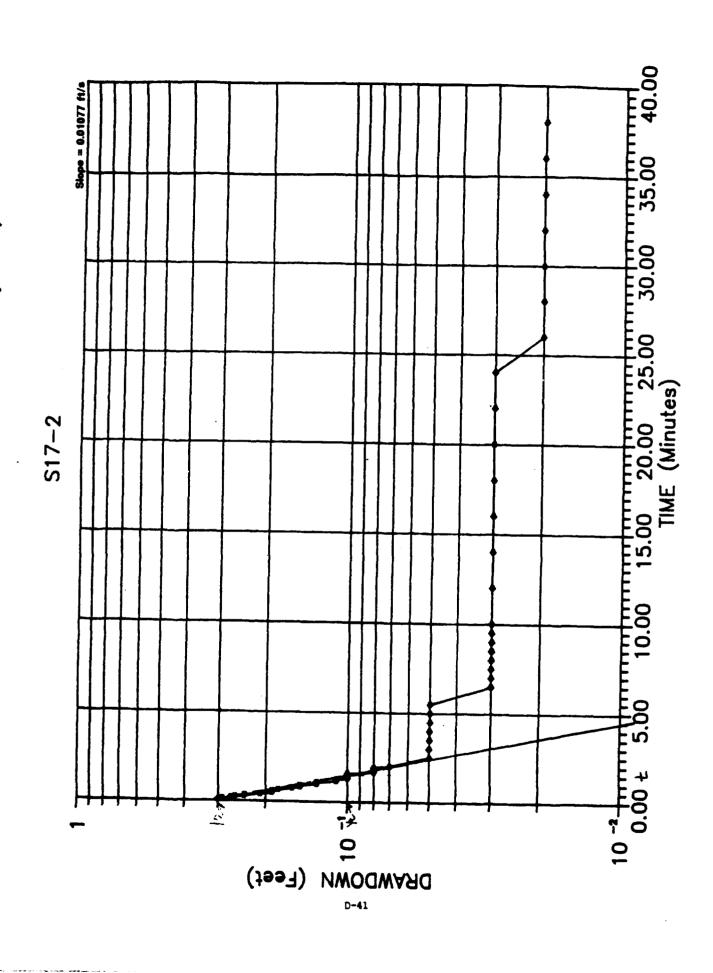


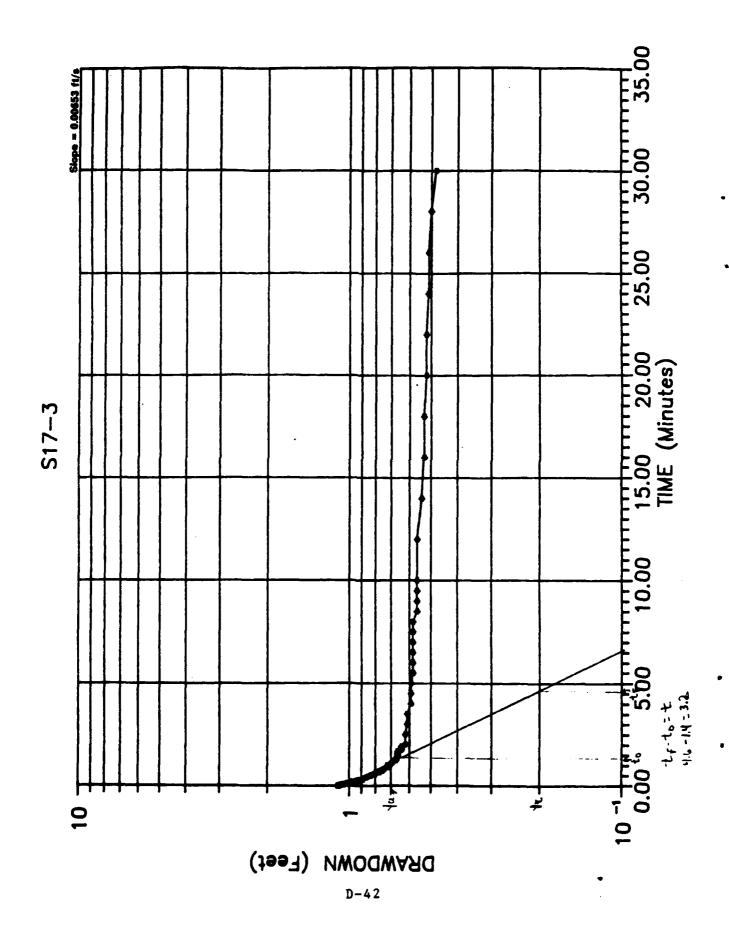


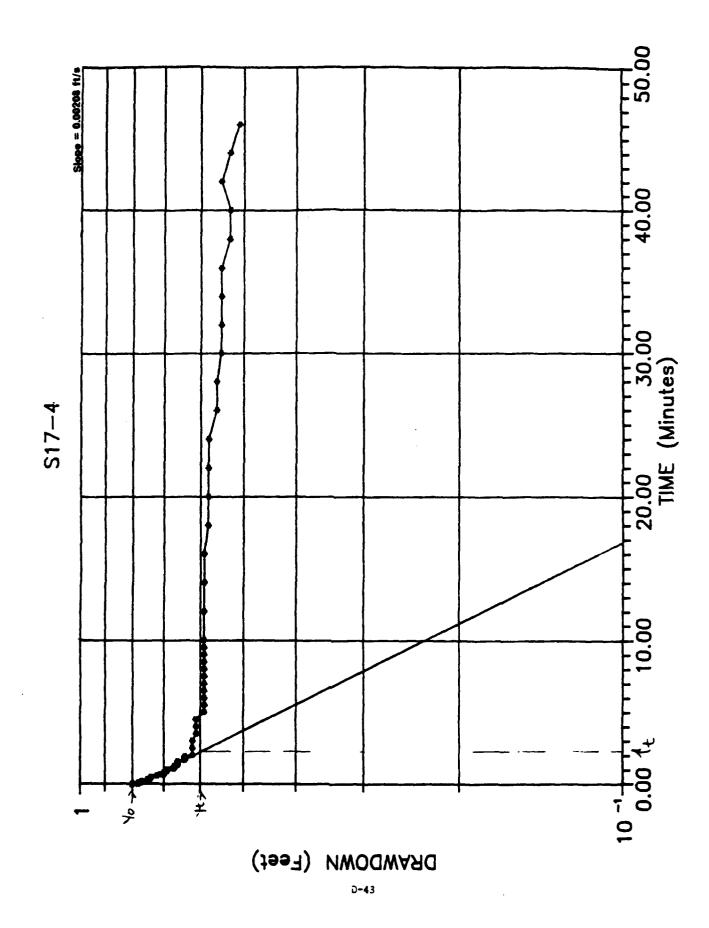




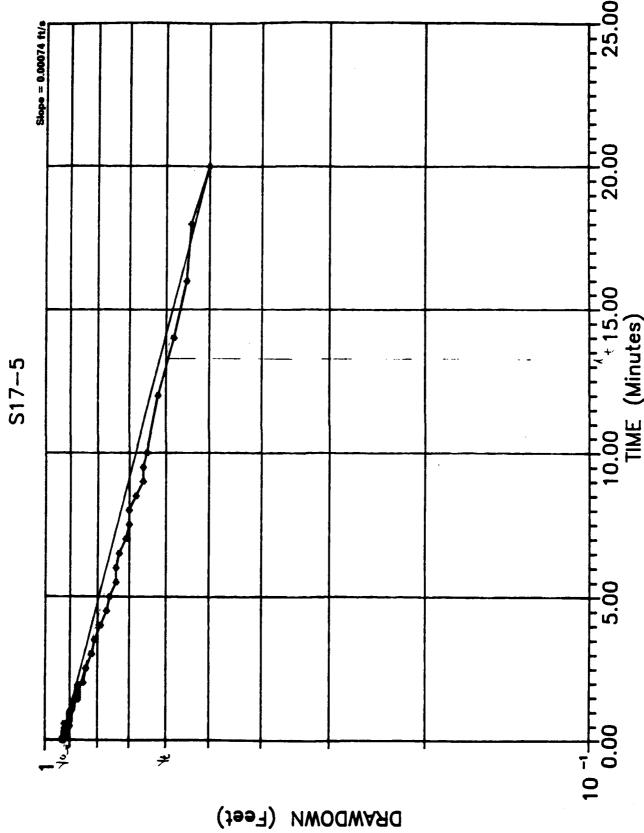




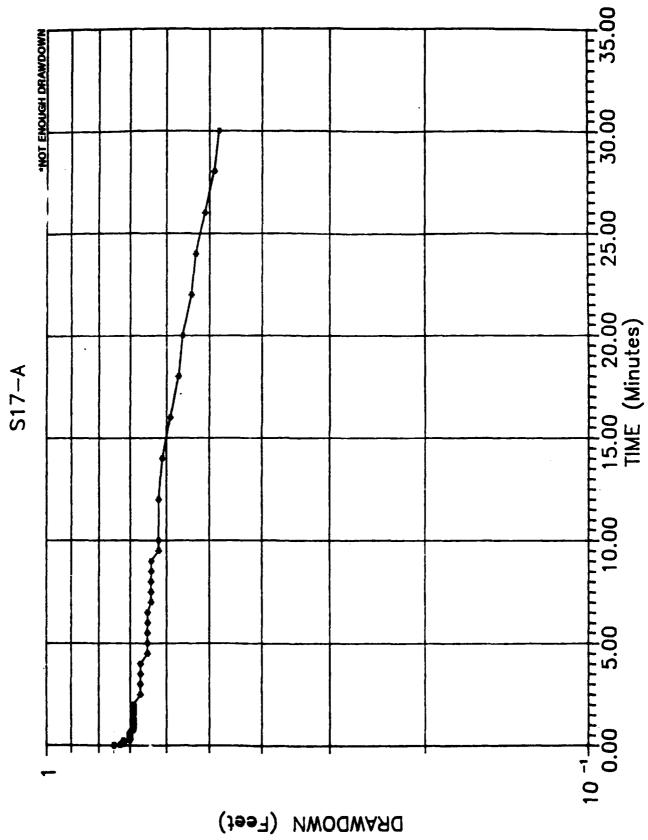


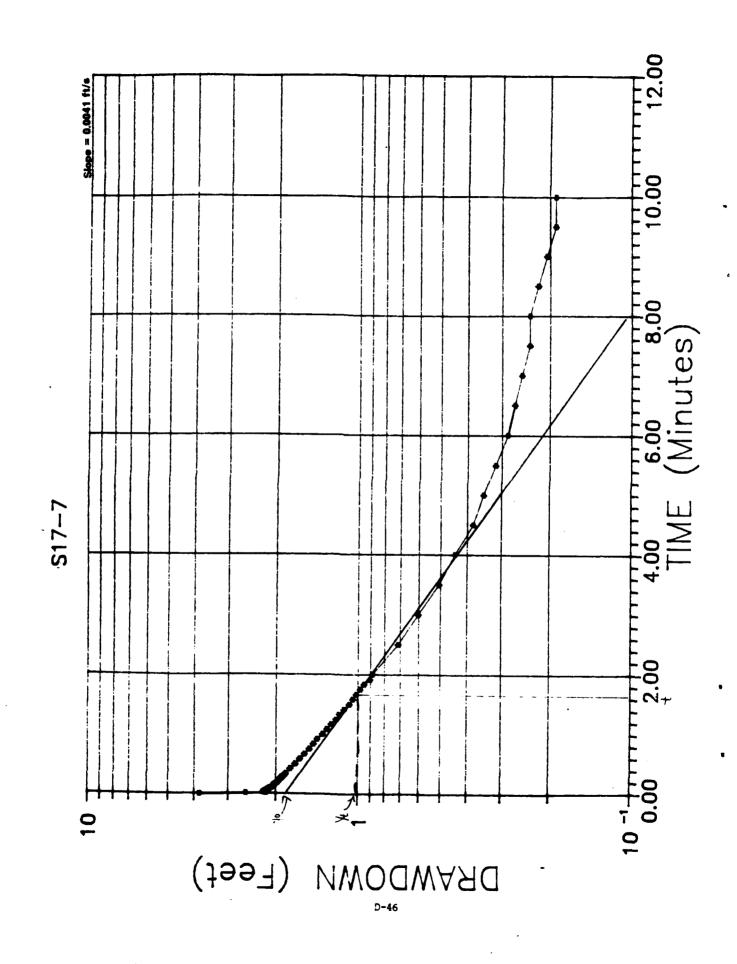


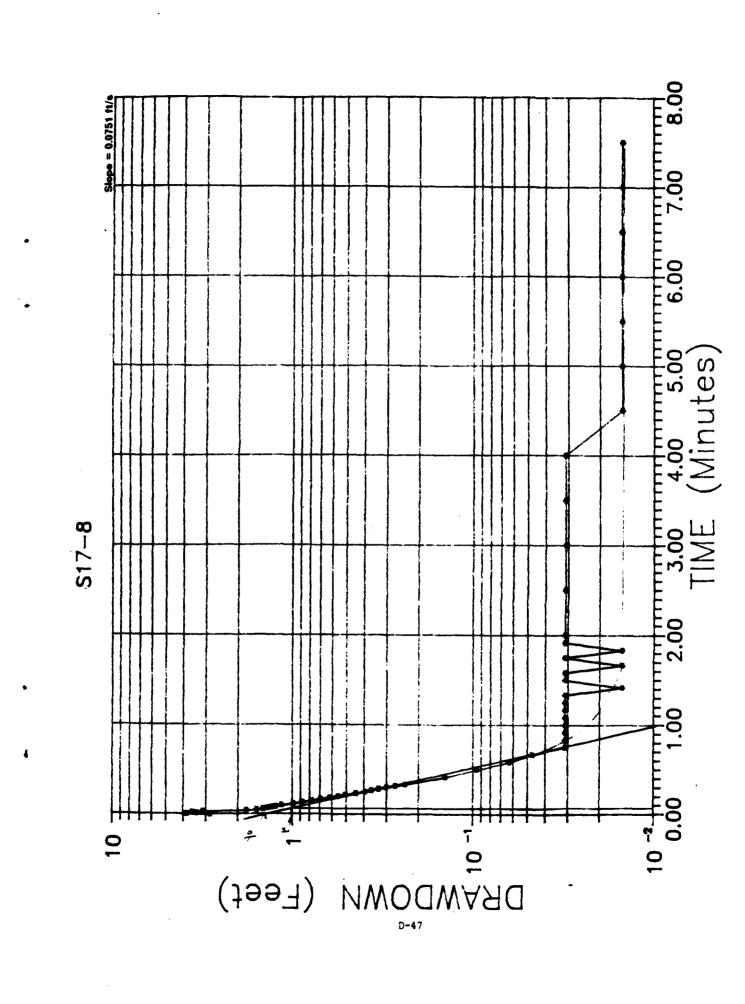


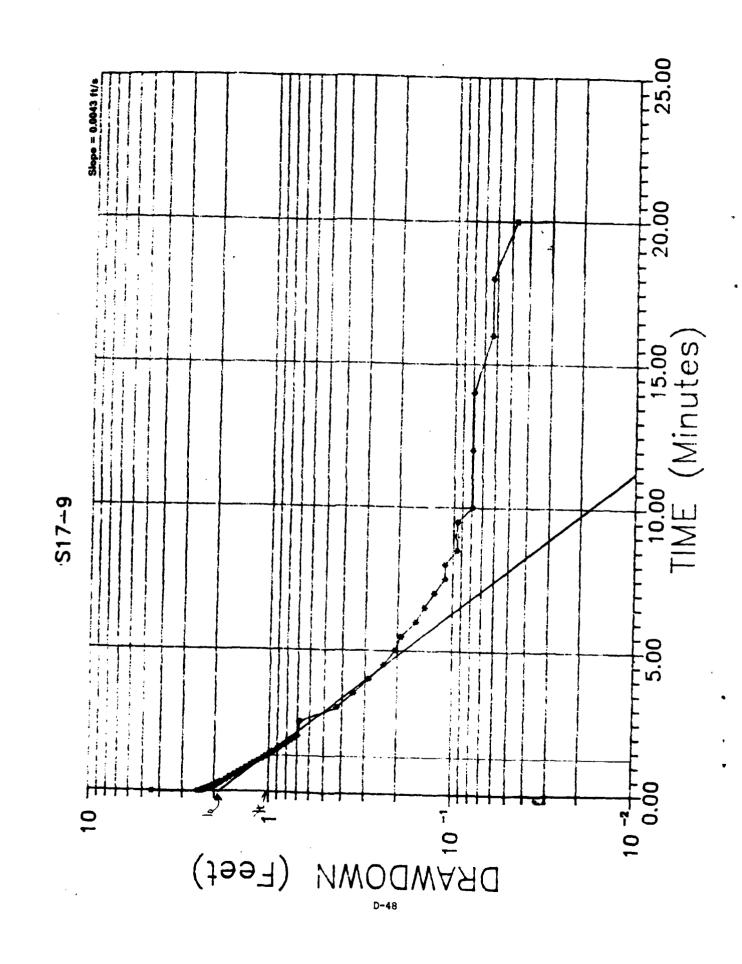


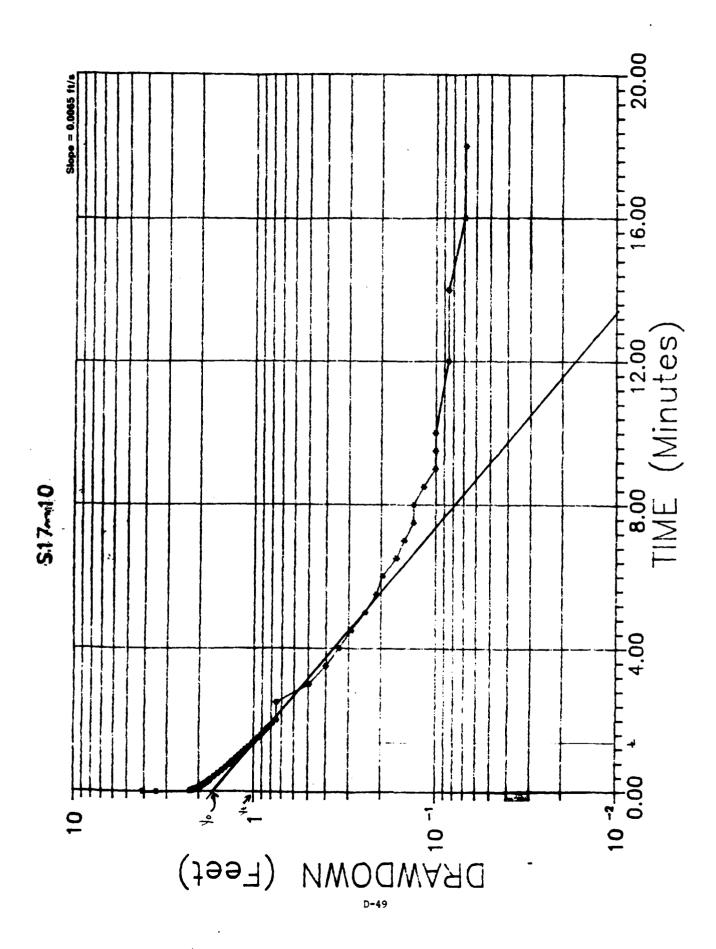


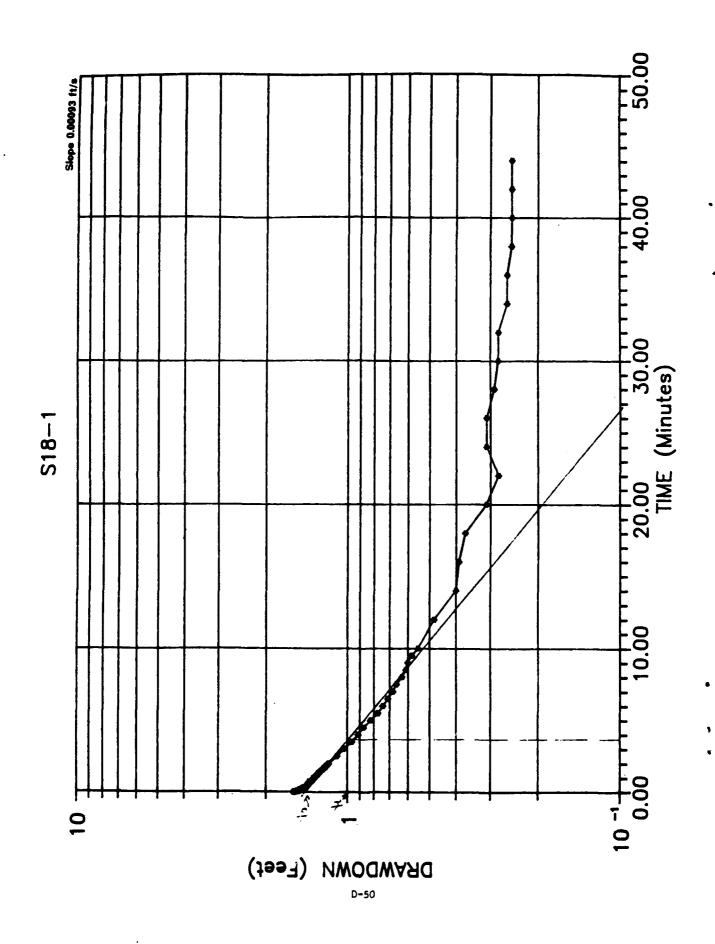




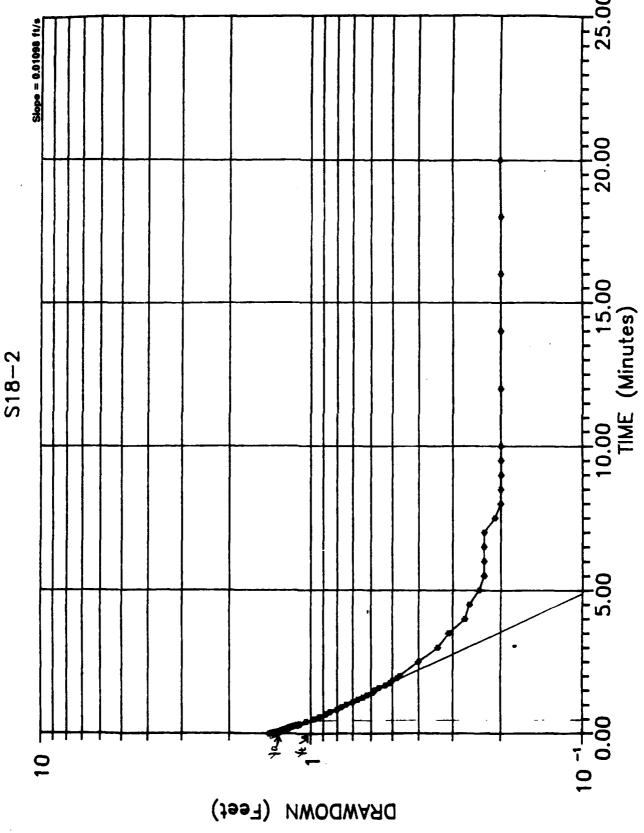


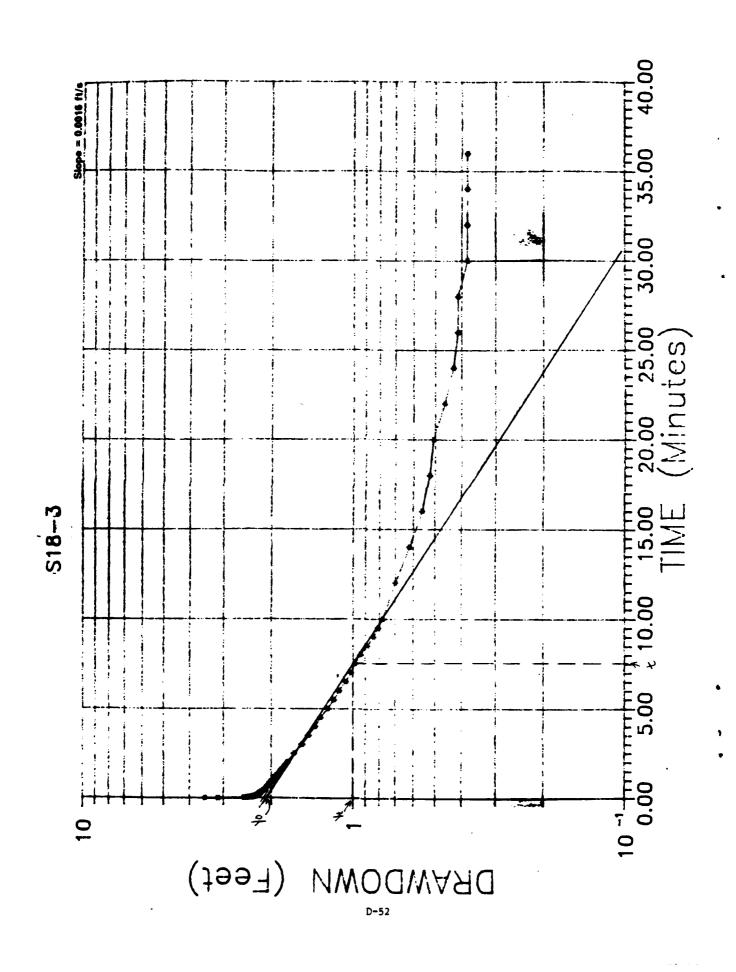


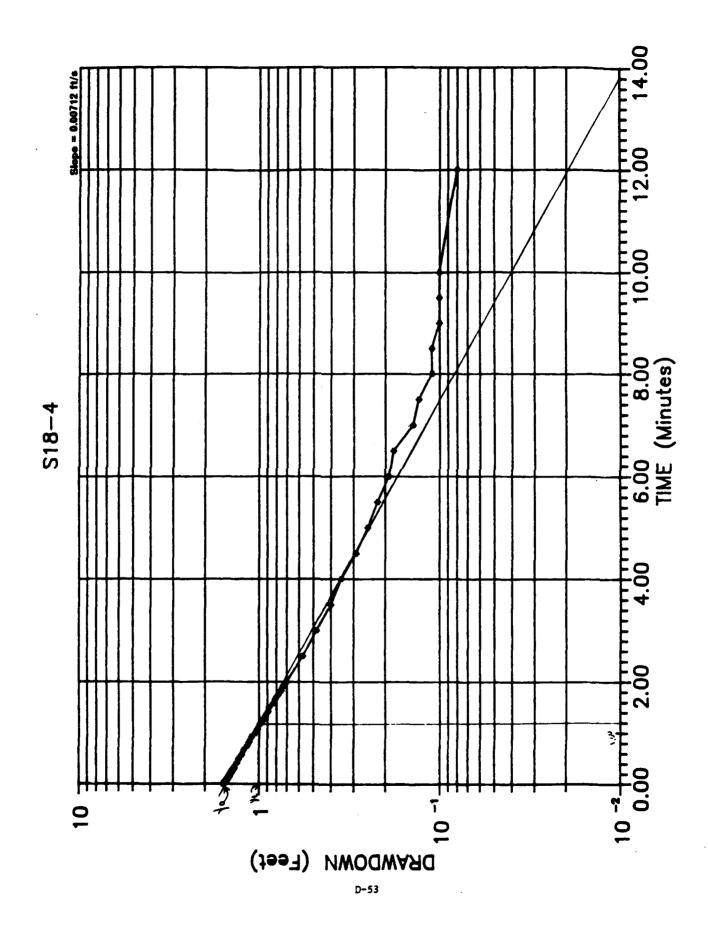


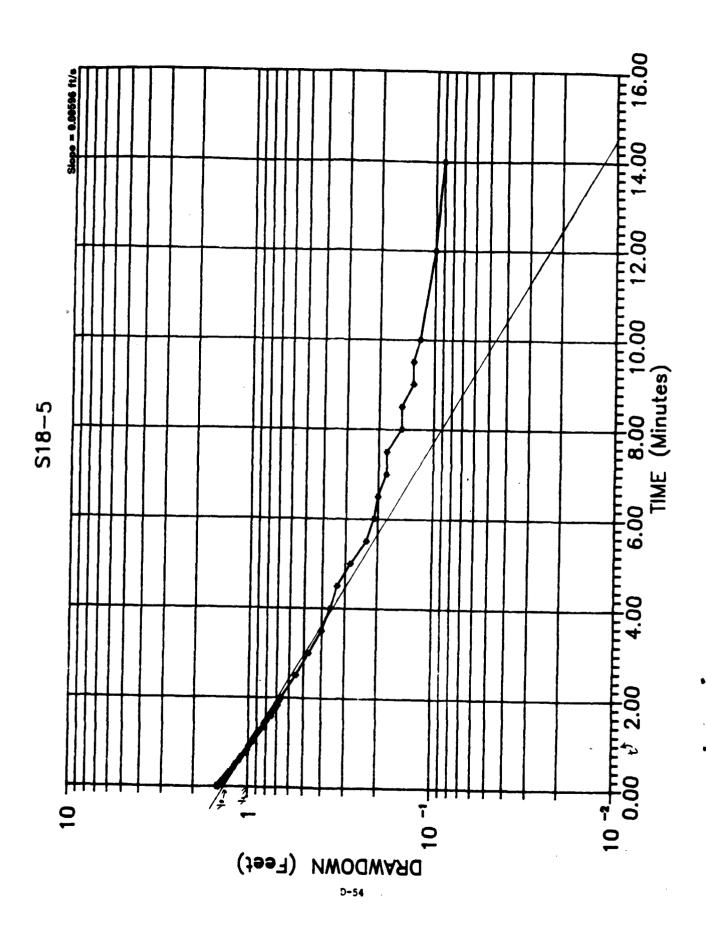


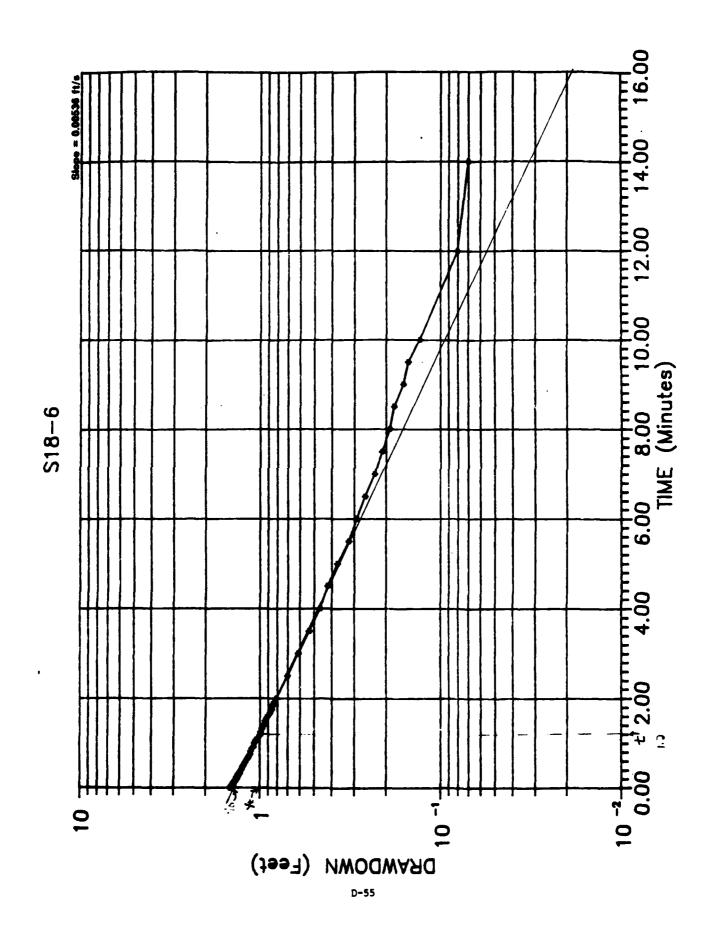


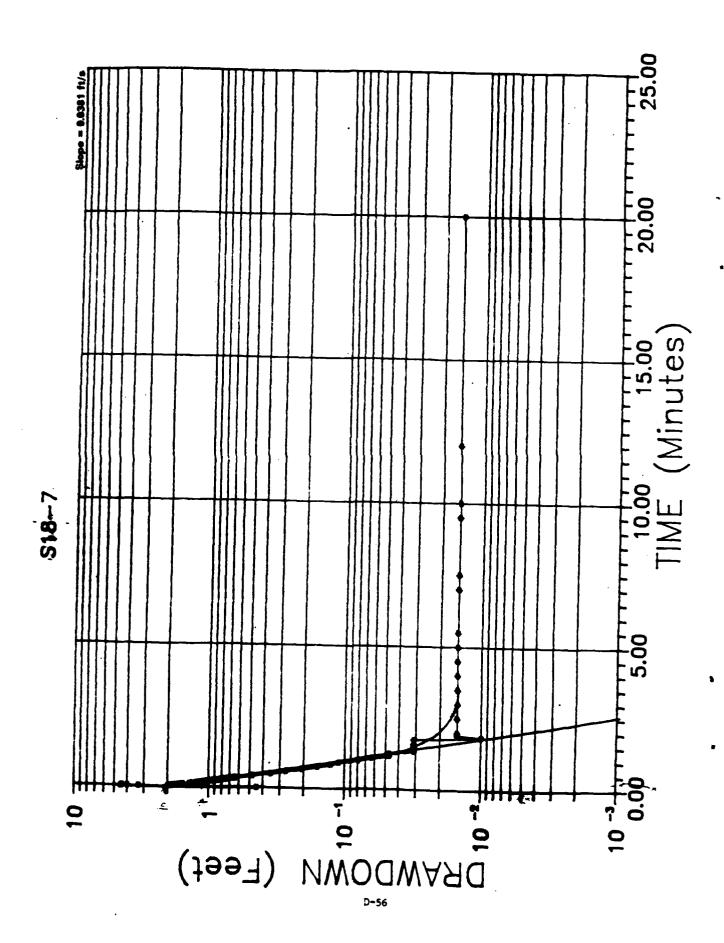






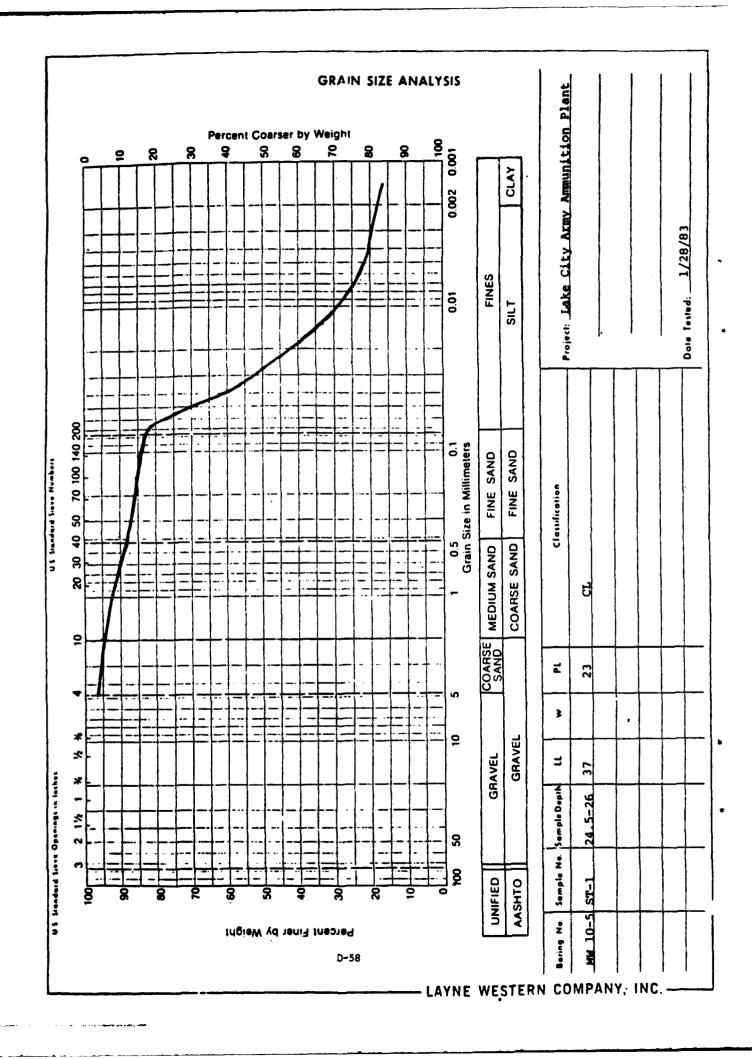


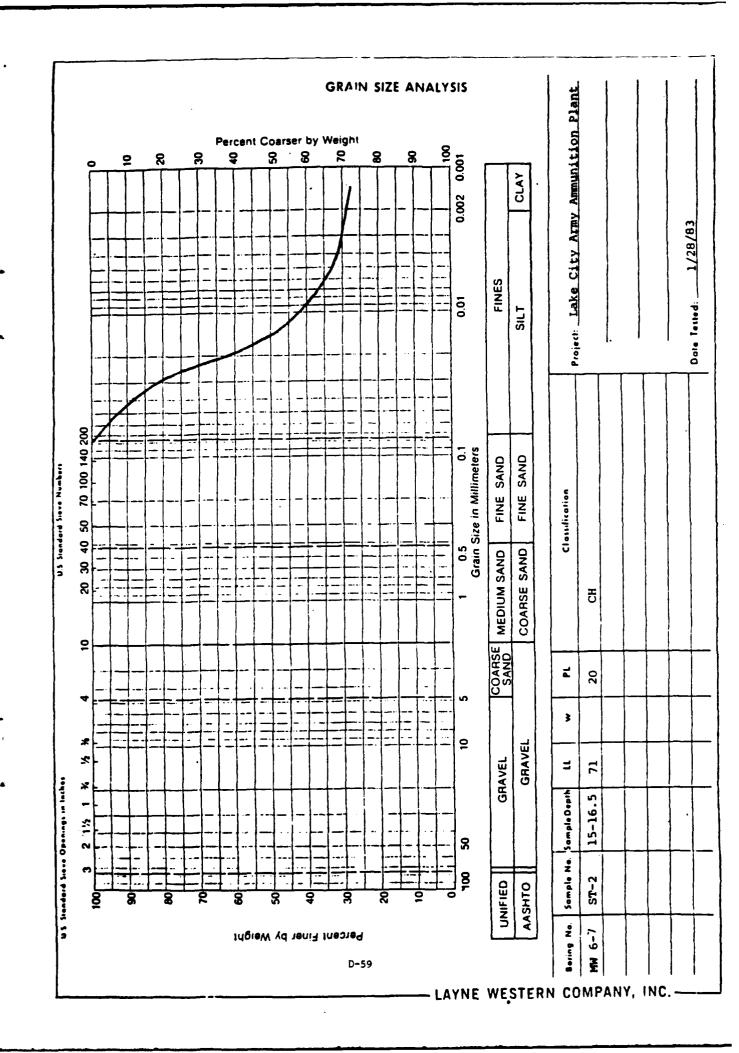


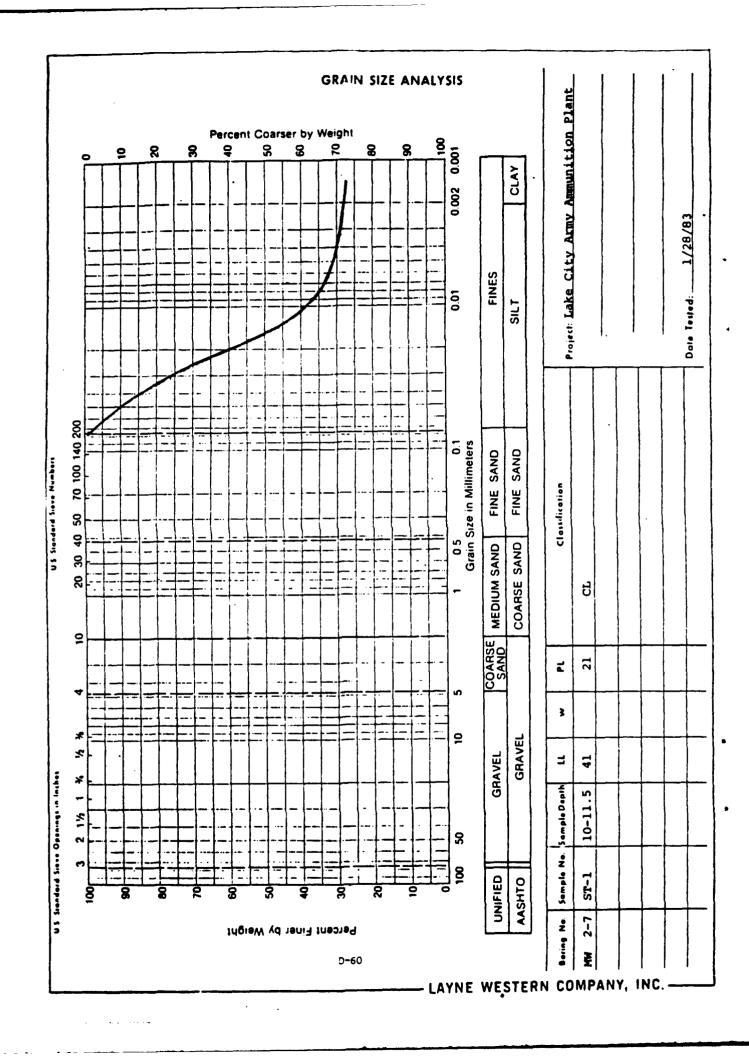


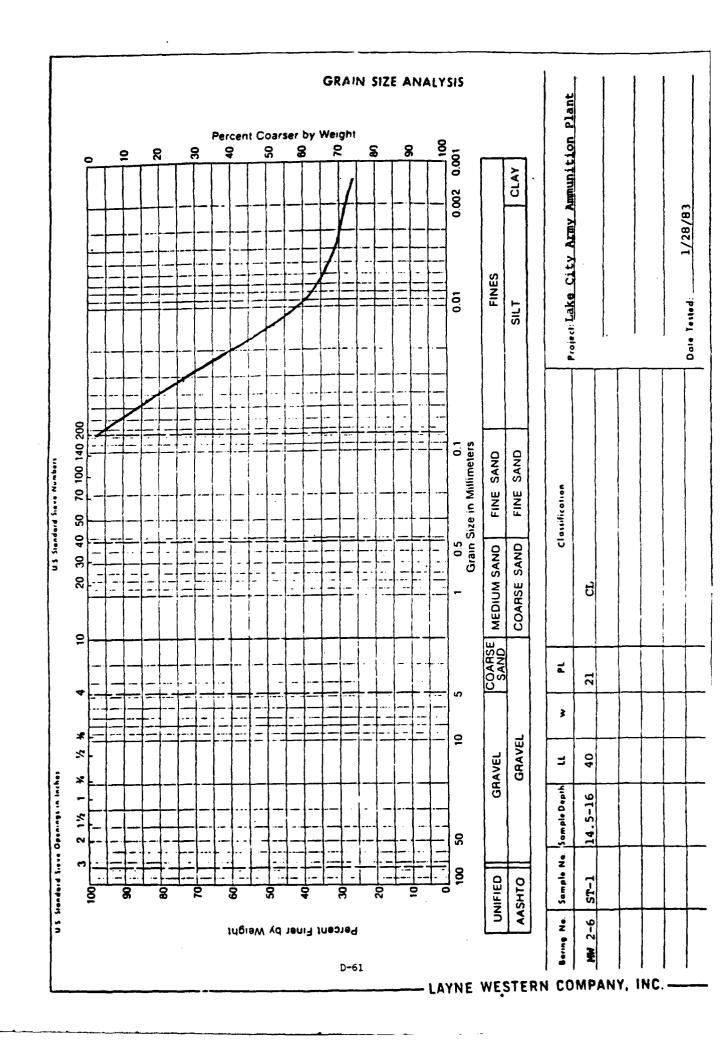
ALLUVIAL SILTY CLAY

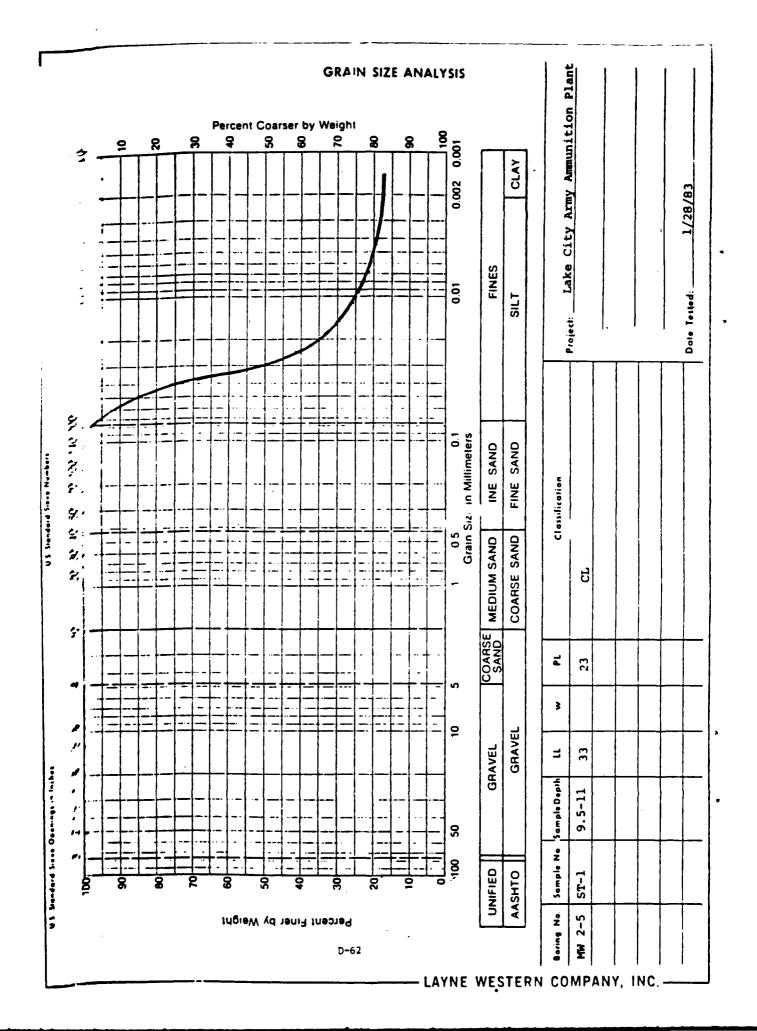
	Project:	Lake City Army Ammunition Independence, Missouri	Missour				; ;						á	Date Jan.	-11	Feb., 1983
-				Ž	1	Incherg		3	Grann Size	S	loum,	Unconfined	88	35	See	
	9	Depth	3	Š		Limits			*	٦	Plestic		T	į	* Vg.	Permeability
	ģ	Elevation	*	bci.	11	P.	ē	Sand	Sile	Clay	2	E	× E	ā	increase	7.64 × 10°5
1	1	0.9 - 5.4	26.6	98.1	46	20	56	2	72	27	빙	+	1			CB/SC.
9-1	STI										7	-	1			2 28 × 10-9
+		0 11-3 0	24.5	7,101	51	20	31	0	63	37	5	-	1			Ch/Sec.
1-1	ST-1		2.87							1		+				2.01 × 10.2
+			1,16	90.6	33	22	11	0	78	22	링	+				CM/Sec.
9-1	ST-2	19.5 -21.0										+			1	9.6 × 10 3
+		0 11 3 0	25.4	101.8	4	20	21	0	59	41	리	+			_	C#/8&C.
6-1	T-LS	9:31		t								+			1	6.0 × 10-8
		3 31 0 31	27.8	97.4	39	20	19	2	76	22	벙	+				Cm/86C.
31-1	1-10		_									+			1	5.43 x 10 B
	1-1-2	9.5 -11.0	27.8	97.2	33	23	91	m	84	13	77	+				
C-7 A	1											+			1	4.14 × 10 0
		1:	27.9	98.3	\$	2	19	3	69	28	강	1			1	C=/sec.
FW 2-6	ST-1	14.5 -10.0			_	_	_								<u> </u>	3.11 × 10
] ;	13	5	۶	~	5	78	ಕ			_	-	. CM/80C.
PEN 2-7	ST-1	10.0 -11.5	27/	7,:/		1	1	_	_						_	01-01 x 10-10
]	F	3	7	c	72	28	₹				_	CM/80C.
MW 6-7	ST-2	15.0 -16.5	27.2	9/.0	1	-	+-	,	-	┞					_	1-01 2 19 1
			1	-∤	3	23	7	1	65	18	7			_	-	× g
MW 10-5	ST-1	1 24.5 -26.0	6.77		1	+-	+-	_						_	-	-
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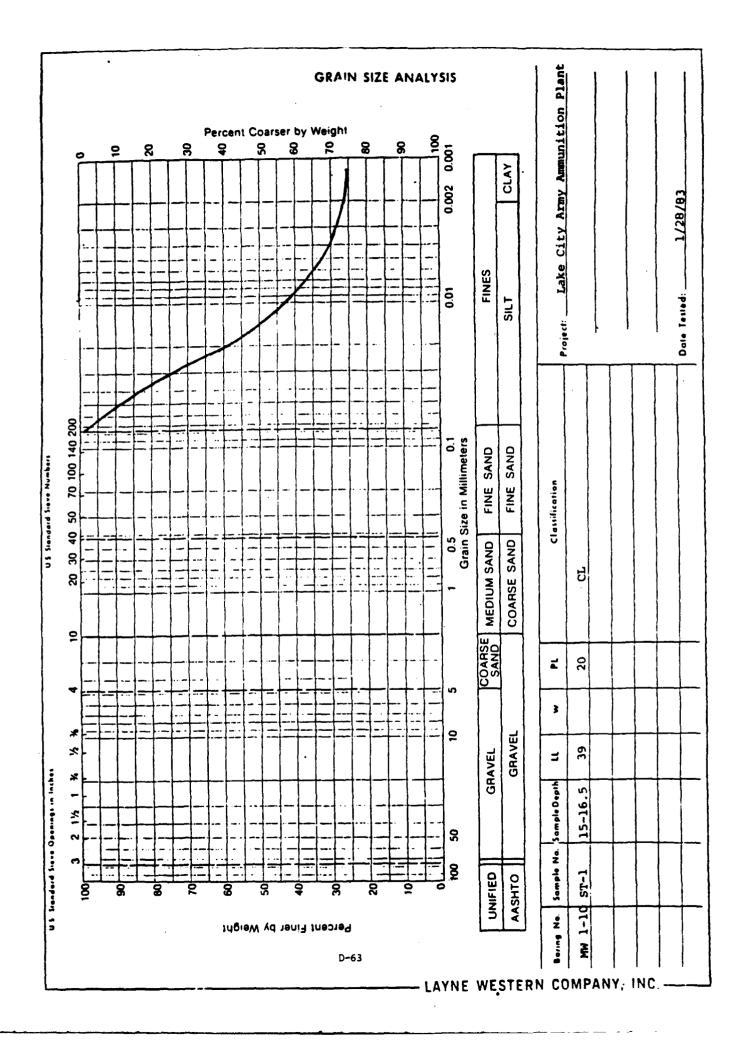


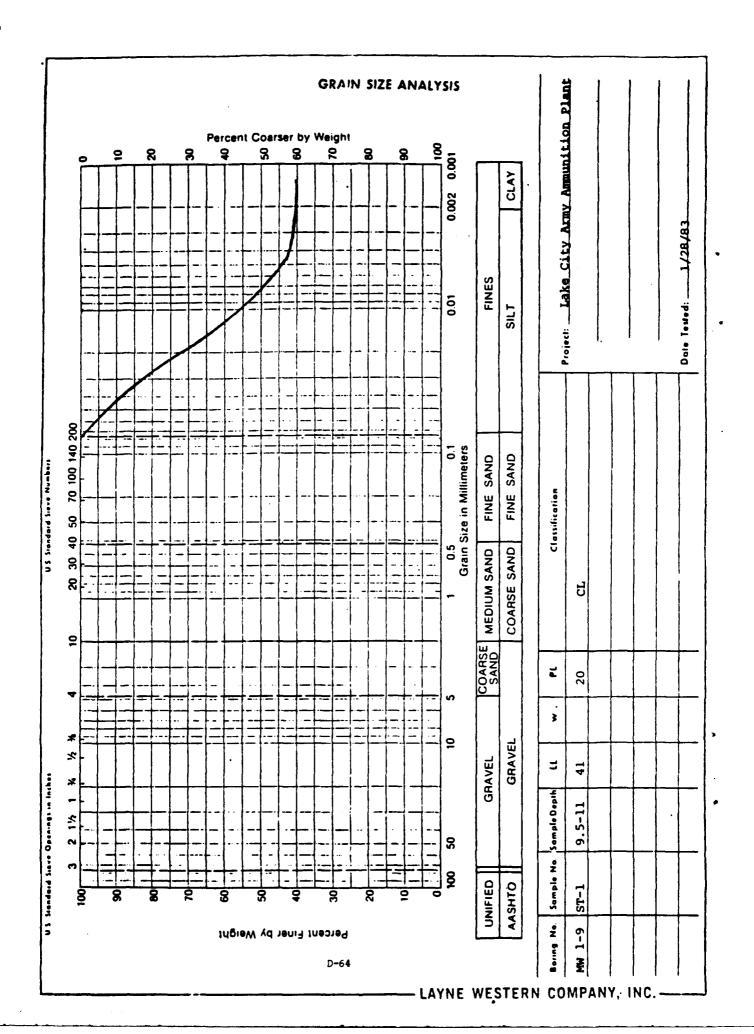


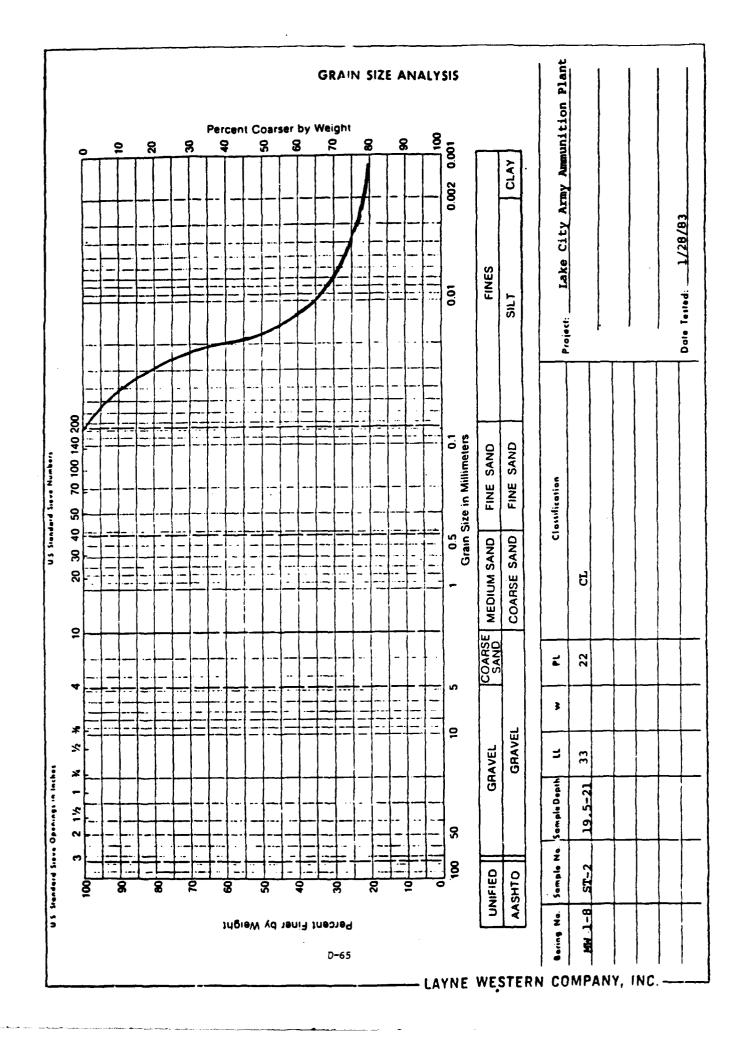


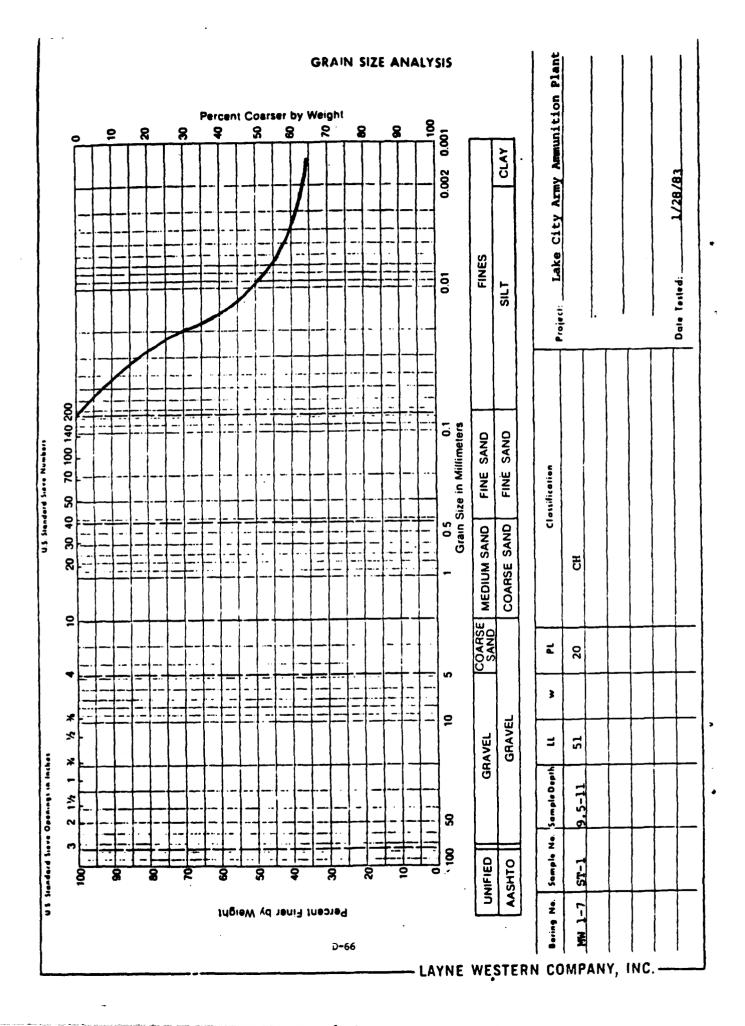


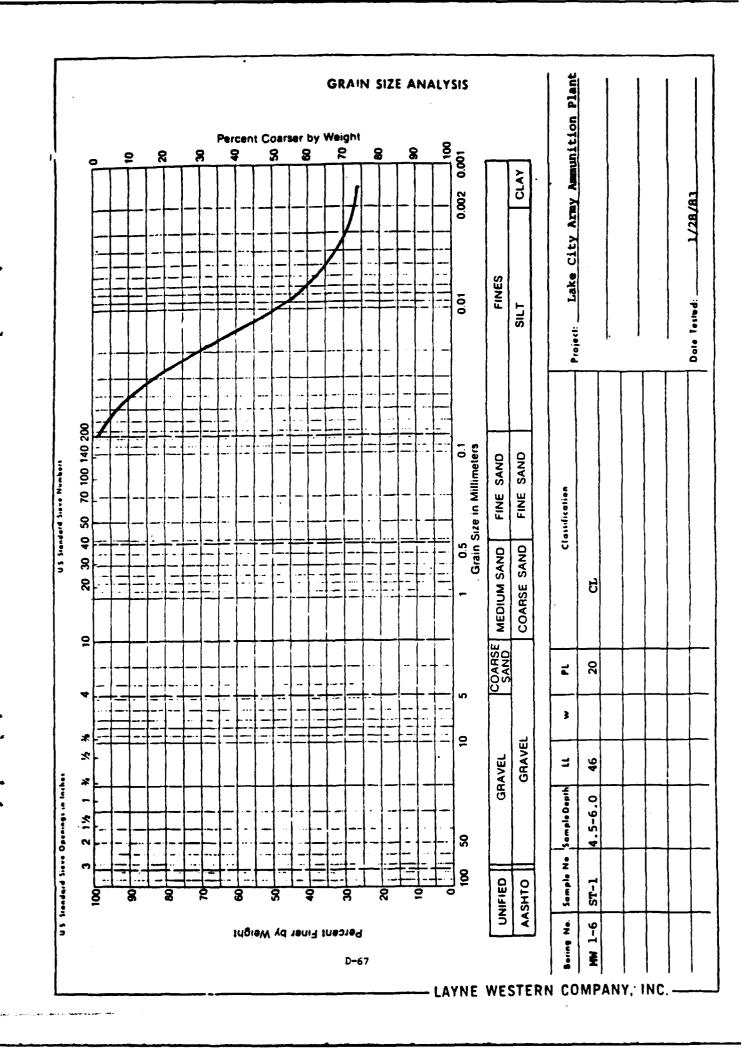












Well No:	Sample No:	ST1	Depth: 10.0-11.5
Description: Gray	brown silty clay	w/iron	& dark stains & nodules
firm	· · · · · · · · · · · · · · · · · · ·		
			-
Moisture Content:	27.7	-	•
Wet Unit Weight:	124.7		

Job Name: Lake C	ity Army Ammunition Plant	
Well No:MW	2-6 Sample No: ST1	Depth: 14.5-16.0'
Description:Gr	ay brown silty clay w/iron	stains, firm
Moisture Content:	27.9	
Wet Unit Weight:	125.7	
Dry Unit Weight:	98.3	
Permeability Coef	ficient for this sample:	4.14 X 10 ⁻⁸ cm/sec.

Job Name: Lake City	y Army Ammunition	Plant	· · · · · · · · · · · · · · · · · · ·
Well No: <u>MW 2-5</u>	Sample No: _	ST1	Depth: 9.5-11.0'
Description: Gray	brown silty clay	w/iron	stains, firm
Moisture Content:	27.8		
Wet Unit Weight:			
Dry Unit Weight:			
Permeability Coeffic		mple:	5.23 X 10 ⁻⁸ cm/sec.

Job Name: Lake City A	rmy Ammunition Plant .
Well No: MW2-1	Sample No: ST1 Depth: 10-11.5'
Description: <u>Very stif</u> stains and nodule	f. gray brown silty clay, with iron
Moisture Content:	25.0
	125.1
Dry Unit Weight:	100.1
Permeability Coefficie	nt for this sample: 3.62×10^{-8} cm./sec.
This permeability coef: material.	ficient indicates a nearly impermeable

Job Name: _	Lake City	Army Ammunitio	n Plant	
Well No:	MW 1-10	Sample No:	STI	Depth: 15.0-16.5
Description	: Gray b	prown silty cla	y w/iron	& dark nodules, firm
Moisture Co	ntent:	27.8		
Wet Unit We	ight:	124.5		
Dry Unit We				
Permeabilit	y Coeffic	ent for this s	ample:	6.06 X 10 ⁻⁸ cm/sec.

Job Name:	Lake Cit	y Army Ammur	nition Plan	nt .	
Well No: _	NW 1-9	Sample	No: ST1	Dep	th: 9.5-11.0'
Description	n: Gray	brown silty	clay w/i	ron nodules	& stains, fire
Moisture Co	ontent: _	25.4			
Wet Unit We	eight:	127.7	,	· · · · · · · · · · · · · · · · · · ·	
Dry Unit We	eight:	101.8	.		
Permeabilit	y Coeffi	cient for th	is sample:	9.60 X	10 ⁻⁹ cm/sec.

Job Name: Lake City	y Army Ammunition	Plant	-	
Well No: <u>MW 1-8</u>	Sample No: _	ST2	Depth:	19.5-21.0
Description: Brown	w/trace gray si	lty clay	w/iron st	ains, firm
				
				•
Moisture Content: _	31.1			· · · · · · · · · · · · · · · · · · ·
Wet Unit Weight:	118.7			
Dry Unit Weight:	90.6			
Dermonbility Cooffic	ione for this co	1	2.01 X 10	-7 cm/sec

Job Name: Lake City	Army Ammunition	Plant		
Well No:MW 1-7	Sample No: _	ST1_	Dept	h: 9.5-11.0
Description: Gray br	own silty clay	w/trace	gravel,	iron nodule
& stains, very stiff				·
Moisture Content:	24.5			· · ·
Wet Unit Weight:	126.6			
Dry Unit Weight:	101.7			
Permeability Coeffici	ent for this sa	mple:	2.78 X 10) ⁻⁹ cm/sec.

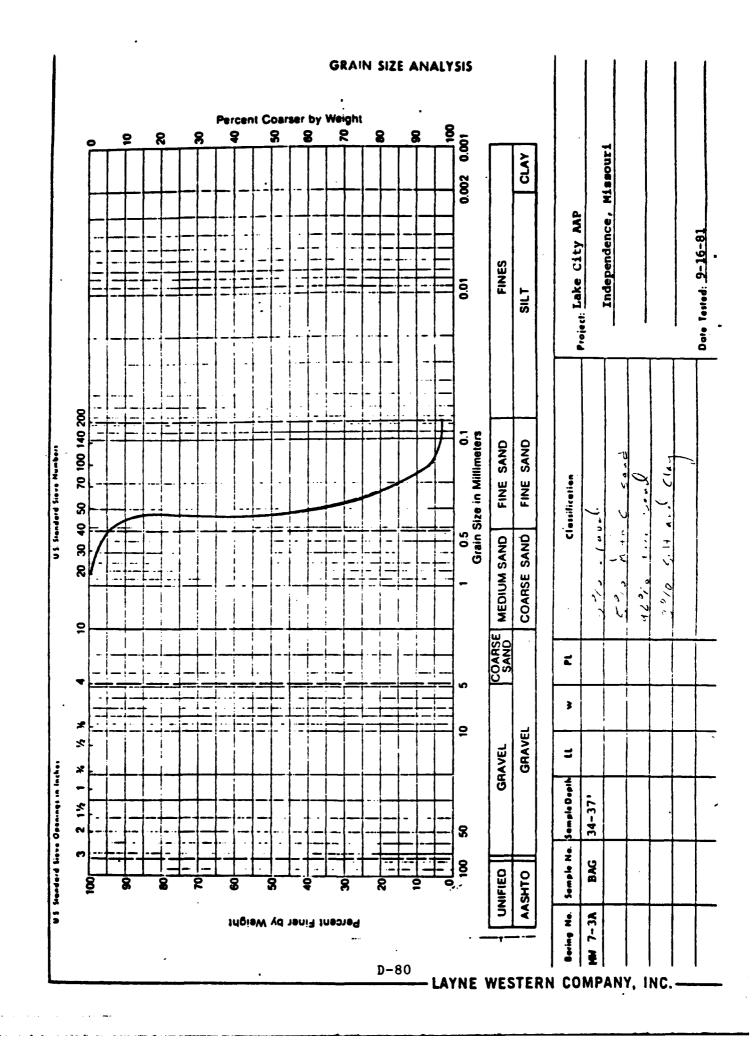
Job Name: Lake C	City Army Ammunition	Plant	·
Well No:MW 1	-6 Sample No:	ST1	_Depth: 4.5-6.0'
Description: Gr	ay brown silty clay,	iron stair	a & nodules, firm
Moisture Content:	26.6		
Wet Unit Weight:	124.3		·
Dry Unit Weight:	98.1		
Permeability Coef	ficient for this san	nple: 7.6	4 X 10 ⁻⁹ cm/sec.

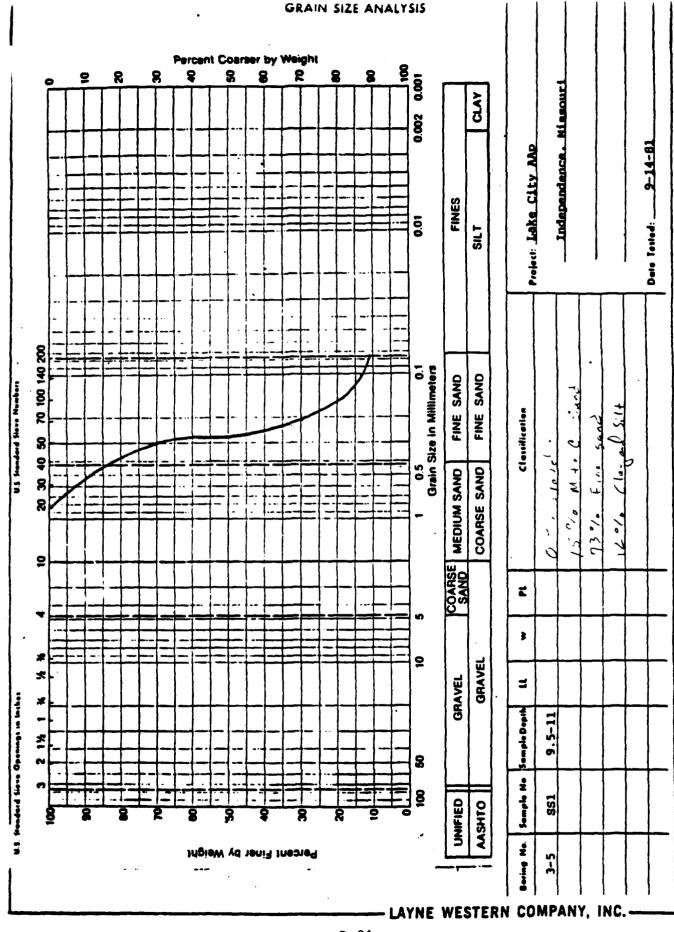
Job Name:	Lake City	Army Ammunitio	n Plant	<u></u>	
Well No: _	MW 10-5	Sample No:	ST1	Depth:_	24.5-26.0
Description	n: Olive	brown shaly cla	ay, very st	iff	
					·
Moisture Co	ontent:	22.4			,
Wet Unit W					
Dry Unit W					
		ent for this s	ample: 1.	61 X 10 ⁻⁷	cm/sec.

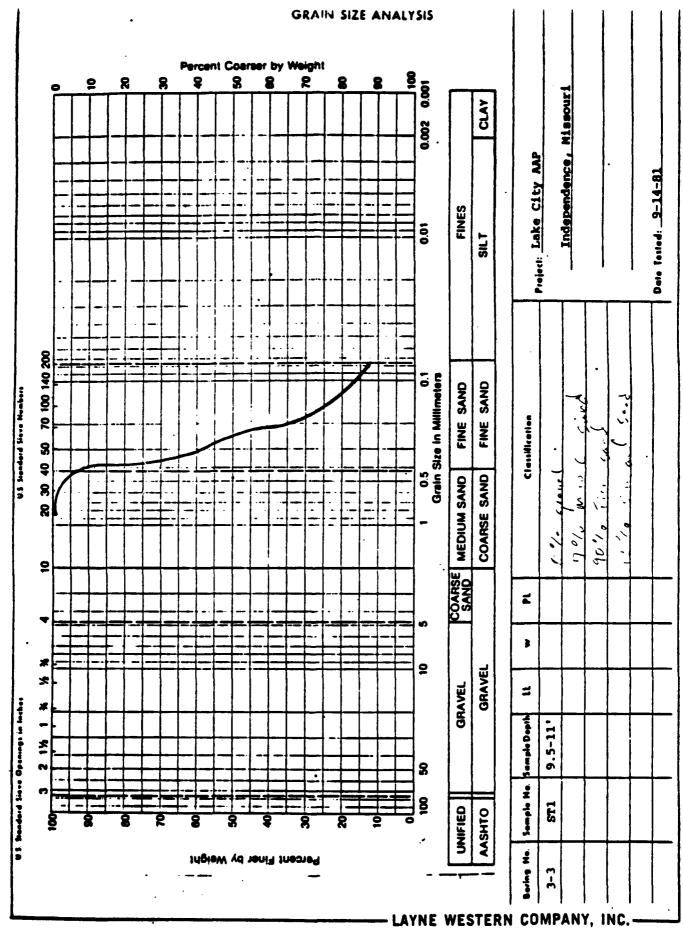
ALLUVIAL SAND

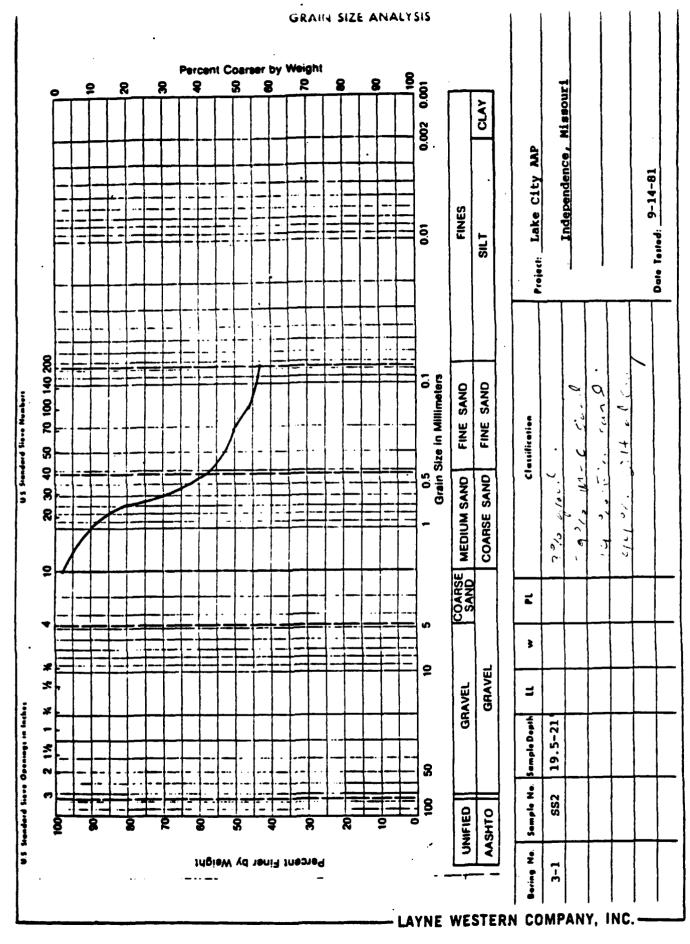
Job Name: Lake City Army Ammunition Plant
Well No:
Description: Gray fine to medium sand with trace of silt.
Moisture Content:
Wet Unit Weight:
Dry Unit Weight:
Permeability Coefficient for this sample: 1.1 x 10 ⁻² cm/sec.
This permeability coefficient for this sample indicates a

Job Name: Lake City Army Ammunition Plant
Well No: <u>MW 9-2</u> Sample No: <u>Bag #1</u> Depth: 32.5'-40.0
Description: Grav silty fine to medium sand
Moisture Content:
Wet Unit Weight:
Dry Unit Weight:
Permeability Coefficient for this sample: 9.0×10^{-3} cm/sec.
This permeability coefficient indicates a medium degree of









PRODUCTION WELL PUMP RATE DATA



11.5 /0 = 121.01.0	SHEET of
	W.O. NO. 2285-05-10
TASK DESCRIPTION Backca kulation to est. individual pump rates.	TASK NO. 0030
PREPARED BY R. Grat DEPT 1535 DATE 9/23/88	APPROVED BY
MATH CHECK BY DEPT DATE	
METHOD REV. BY DEPT DATE	DEPT DATE

Designation	Pump	Calculated Q (gpm)
A	(7AA	433
В	17 BB	350
C	17cc	*
D E	1700	433
E	17E	*
F	ITEE	358
G	17FF	150
Н	176G .	*
H		
J	175	*
κ .	1755	442
L	17 K	267
M	17KK	292

* Not used betwn 5/1/88 and 5/16/88
- Pump no in.

W.S.

, Some Continues	SHEET 2 of 2
CLIENT/SUBJECT Air Force / Pump Test Data Reduction	W.O. NO. 2285-05-10
TASK DESCRIPTION Back colc. to estimate individual pumping nates	TASK NO0030
PREPARED BY R. Grat DEPT 1535 DATE 4 9/23/88	APPROVED BY
MATH CHECK BY DEPT DATE	
METHOD REV. BY DEPT DATE	DEPT DATE
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APPENDIX E

EQUATIONS USED FOR ANALYSIS OF PUMPING TEST DATA

Barometric Efficiency (BE)

 $BE = \frac{wdh}{dP}$ where

w = unit weight of water

dh = change in head

dP = change in atmospheric pressure

Relationship of Aquifer Storage (S) to BE

 $s = \frac{n\beta pwq}{BE}$ where,

n = porosity

 β = aquifer compressibility

 p_{μ} = density of water

g = gravitational constant

Equations for calculating aquifer characteristics for a leaky system with release from storage from the aquitard layer and partially penetrating wells (Hantush, 1964; Walton 1979).

 $s = \frac{Q}{4\pi T} W(u,T) + W(\frac{r}{m} \sqrt{P_v/P_h} 1',d',y') \text{ where,}$

s = drawdown (ft). T = transmissivity

Q = discharge

W(u,T) = well function for a leaky confined aquifer

 $W(r/m \sqrt{P_v/P_h})$ = well function correction for a leaky confined aquifer with partially penetrating wells having

no storage capacity and long pumping periods.

r = radial distance from the pumping well to the observation well (ft.)

m = aquifer thickness

P = vertical permability of aquifer
Ph = horizontal permeability of aquifer
1',d',y' = define geometry of production well
and observation wells relative.

= <u>Tt</u> where,

1.87 r²

u = dimensionless parameter of the well function exponential

defined through curve matching.

t = time (days)

S

T = transmissivity (gpd/ft)

APPENDIX F STATISTICAL BACKGROUND VALUES

Calculation of statistical significance of individual parameter data with average background data using Cochran's Approximation to the Behrens-Fisher students' t-test as adapted from 40CFR Part 264, Appendix IV.

Calculate the mean (\vec{x}_B) and variance (S^2_B) for background data.

For the monitoring date, the analytical result constitutes the value (V_m) , and its variance (S^2_m) will be zero.

This data is used to calculate a t-statistic (t*), and a comparison t-statistic (t_c).

The value of t* is calculated as follows:

$$t^* = \frac{v_m - \bar{x}_B}{\sqrt{(s^2_B/N_B) + (s^2_m/N_m)}}$$

If the value of t* is negative $(X_B > V_m)$, then there can be no significant increase, since the background is greater than the monitoring point.

If the value of t* is positive ($V_m > X_B$) then the t_c value must be calculated for comparison:

$$\epsilon_c = \frac{(s^2_B M_B) (+_B) + (s^2_m/N_m) (\epsilon_m)}{(s^2_B M_B) + (s^2_m/N_m)}$$

Since the monitoring value variance (S_m^2) is zero, the formula

reduces to:
$$t_{c} = \frac{(s^{2}_{B}M_{b})(t_{B})}{(s^{2}_{B}M_{B})} = t_{B}$$

If the value of t* is equal to or larger than to, then there most likely has been a significant increase for the parameter.

If the value of t* is less than to, then there most likely has not been a significant increase for the parameter.

The use of zero variance for the monitoring value is rather conservative, since no allowance for analytical variability is considered.

However, this conservative approach may be justified under these circumstances.

Solve FOR the value Vm where t= tc.

If a discrete monitoring value is Z Vm then there most likely has been a significant increase above background for the parameter.

If a discrete monitorine value is < Vm then there must likely has not been a significant increase above bringround for the parameter.

$$t^* = \frac{\sqrt{m - \chi_0}}{\sqrt{\frac{S^2 g}{N g} + \frac{S^2 m}{N}}} = \frac{\sqrt{m - \chi_0}}{\sqrt{\frac{S^2 g}{N g}}} = \frac{\sqrt{m - \chi_0}}{\sqrt{N} g}$$

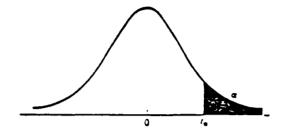
$$V_{M} = t^{*} \left(\frac{S_{0}}{V_{N_{0}}} \right) + \overline{X}_{0} = \overline{X}_{0} + t_{0} \underline{S}_{0}$$
 where $\overline{X}_{0} = B_{N_{0}}$ are $\overline{X}_{0} = B_{N_{0}}$ one tail AT

$$f = 4-1=3$$
 $t_0 = 2.353$

$$V_{m} = 17.5 + 2.353 \left(\frac{5.59}{\sqrt{4}} \right) = 24.08$$

Vm = 17.5 + 2.353 (5.59) = 24.08 Therefore All monitoring data show. above that is 2 Vm falls outside Har 954 contide in level & 11

TABLE E Student (Distribution



The following table provides the values of t_a that correspond to a given upper-tail area z and a specified number of degrees of freedom.

Degrees					Upper-T	ail Area z				
Freedom	.4	.25	.1	.05	.025	.01	.005	0025	.00ι	.0005
1	0.325	1.000	3.07\$	6.314	12.706	31.321	63 657	127.32	313.31	636.62
2	.239	0.316	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.591
3	.277	.765	1.638	2.353	3.182	4.541	5.341	7.453	10.214	12.92
4	.271	.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	3.61
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	4,773	5 393	6.55
6	.265	.718	1.440	1.943	2.447	3.143	3,707	4.317	5.208	5.95
7	.263	.711	1.415	1.595	2.365	2.998	3.499	4.029	4.785	5.40
8	.262	.706	1.397	1.360	2.306	2.196	3.355	3.833	4.50 t	5.04
9	.261	.703	1.383	1.833	2.262	. 2. 32 1	3.250	3.6 9 0	4.197	4.73
10	0.260	0.700	1.372	1.812	2,228	2,764	3.169	3.581	4.144	4.53
ii	.260	.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4,43
12	.219	.695	1.356	1.782	2.179	2.681	3.055	3.423	3.930	4.31
13	.259	. 594	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.22
14	.258	.692	1.345	1.761	2.145	2.624	2977	3.326	3.737	4.14
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.236	3.733	4 07
16	.258	.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4 01
17	2.57	.689	1.333	1.740	2.110	2.567	2.398	3.222	3.646	3.96
18	.257	.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.92
19	257	.688	1.328	1.729	2.093	2.539	2.361	3.174	3.579	3.88
20	0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.35
21	.257	.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.31
22	.256	.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.79
23	.256	.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.76
24	.256	.685	1.318	1.711	2.064	2492	2.797	3.09 i	3.467	3.74
25	0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.72
26	.256	.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.70
27	.256	.684	- 1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.69
28	.256	.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.67
29	.256	.683	1.311	1.699	2.045	2.462	2756	3.038	3.396	3.65
30	0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.64
49	.255	.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.55
60	.254	.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.46
120	.254	.677	1.289	1.658	1.980	2.358	2.617	2.360	3.160	3.37
<	.253	.674	1.282	1.645	1.960	2.326	2576	2.807	3.090	3.29

source: E.S. Pearson and H.O. Harriey, Biometrika Tables for Stansmann, Vol. I. London: Cambridge University Press, 1966. Partly derived from Table III of Fisher and Yates. Statistical Tables for Biological, Agricultural and Medical Research, published by Longman Group Ltd., London (previously published by Oliver & Boyd, Edinburgh, 1963). Reproduced with permission of the authors and publishers.

	,——	We 11		We11	Weil 4-6		We 1 1 8-6		Well 11-3		We 11 17-1	49 You	Į.		Vm	
BACKGROUND GROUNDWATER		Round	Round 2	Round P	buno)	Round 2	Round 1	Round 2	Round l	Round 2	Round	(300)	ХВ	SB	Log	Anti- Log
	dis	CIN	ÜN	S	NO	0.67	ON	CN	CN	ND	GN	0.18	0.23	0.15	0.32	2.07
Ant imony	tot	Ê	CN	â	N.	1.06	CIN.	ON O	QN	GN.	ON.	0.18	0.27	0.26	0.42	2.64
30.4	dis	Ĝ	QN	Ŝ	Î	(N	GN	Ê	S	G.	ÛN.	0.40				2.51
	tot	Î	ÛN	1.23	C.X	QN	0.71	0.88	ON.	NI)	NI)	0.40	0.56	0.27	0.72	5.21
	dis		2.05	2.51		2.12		2.14		2.37		1.10	2.25	0.17	2.41	2.58
Bariun	tot		2.13	3.17		2.19		2.60		2.56		1.10	2.52	0.39	2.89	780.
	dis	Û	Û	Ê	N O	ŝ	ÎN	S	ÛN.	Q.	QN	0.05				0.05
Beryllium	tot	5.47	-0.30	-0.26	-0.70	-0.70	-0.15	-0.09	-0.22	-0.30	-0.04	-1.30	-0.23	0.32	-0.04	0.90
	dis	CN	ÛN	GN	ON	ON ON	ÛN	GZ	O.	ND	QN	0.41				2.55
Cadinium	tot	QN.	ÛN	1.39	ON	1.52	GN	C N	GN	QN	Q.	0.41	0.62	0.42	0.86	7.31
	dis	(N	ĆŅ.	QN	ŝ	GM GM	GN	ĝ	GN GN	S.	QN	1.27				18.62
Chromium	tot	Û	ON.	1.69	Ŝ	1.54	ÜN	GN.	ND	G N	ÛN	1.27	1.34	0.14	1.42	26.38
	die	ĝ	ĜN	ÛN	0.70	ÎZ	GN	G _N	Ñ.	Ê	0.56	-0.05	0.09	0.27	0.25	1.76
Copper	tot	1.85	1.04	2.30	-	0.59	1.62	1.48	1.35	1.48	1.12	-0.05	07.1	0.45	99.1	1.66 45.82

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XB 0.29 0.99 0.84 0.84 0.84 0.88 0.88 2.02 2.02			We 1 1 1 - 4		Well 1-5	Well 4-6		We11 8-6		Well 11-3	3	Well 17-1	yo , sh			>	
Harton H			Round	Round 2		Round	Round 2	1 1		Round 1	Round 2	Round	(200)	ХВ	SB	log	ant 1- log
tot life ND nD nD ND ND ND ND ND ND ND ND ND ND ND ND ND	Lead	die	0.50	0.92	QN	Q	ND	GN	ND	(IN	0.75	QN	01.0	0.29	0.30	0.46	2.91
tot ND ND ND ND ND ND ND ND ND ND ND ND ND		tot	1.76	S	1.65	0.55	Q.	1.36	1.30	GN	1.42		0.10	0.99	99.0	1.37	23.58
tot ND ND ND ND ND ND ND ND ND ND ND ND ND	:	dis	-0.70	ND	ON	ON	ND	ÎN	GN	GIN	ÛN.	(IN	1	-1.06	0	-0.99	0.08
tot 1.90 ND 2.54 1.16 0.99 1.48 1.68 1.5 1.71 1.45 0.68 1.51 1.14 ND ND ND ND ND ND ND ND ND ND ND ND ND	Mercury	tot	ND	ND	CIN	QN	ND	ND	ND	ND	ON	QN	-1.10				0.08
tot 1.90 ND 2.54 1.16 0.99 1.48 1.68 1.5 1.71 1.45 0.68 1.51 dis 0.87 ND ND ND ND ND ND ND ND ND ND ND ND ND	;	dis	1.15	ND	ON	1.22	OND	ON	ND	1.28	(IN	(IN	0.68	0.84	0.25	0.98	99.6
dis 0.87 ND	Nickel	tot	1.90	ND	2.54	1.16	0.99	1.48	1.68	1.5	1.71	1.45	0.68	1.51	0.49	1.79	62.23
tot ND 0.75 ND ND ND ND ND ND ND ND ND ND ND ND HD O.40 0.43 41s ND -0.68 -0.28 ND ND ND -0.49 ND ND ND -1.05-0.88 tot 2.65 1.52 1.32 2.43 1.48 2.71 1.26 2.96 ND 2.90 0.93 2.70 tot 2.87 1.79 3.04 2.85 2.77 2.36 2.99 2.34 2.98 0.93 2.70		dis	0.87	ND	GN	QN.	QN	GN	UN	Q.N.	QN	QN Q	0.40				2.5
tot ND ND ND ND ND ND ND ND ND ND ND ND ND	Selenium	tot	ND	0.75	îz	Q _N	ON ON	QN	QN.	ON	ON	ND	0.40	7.	0.10	0.48	3.79
tot ND -0.68 -0.28 ND ND -0.49 ND ND -1.05-0.88 dis 2.65 1.52 1.32 2.43 1.48 2.71 1.26 2.96 ND 2.90 0.93 2.02 tot 2.87 1.79 3.04 3.04 2.85 2.77 2.36 2.99 2.34 2.98 0.93 2.70		dis	ND	QN	GN	QN	ON	-QN	ND	QN	(IN	ON	-1.05				0.09
d1s 2.65 1.52 1.32 2.43 1.48 2.71 1.26 2.96 ND 2.90 0.93 2.02 tot 2.87 1.79 3.04 3.04 2.85 2.77 2.36 2.99 2.34 2.98 0.93 2.70	311061	tot	ND	-0.68	-0.28	GN	QN	QN	-0.49	GN	QN	ON	-1.05		0.27	-0.72	0.19
tot 2.87 1.79 3.04 3.04 2.85 2.77 2.36 2.99 2.34 2.98 0.93 2.70		dis	2.65	1.52	1.32	4.	1.48	2.71	1.26	2.96	ON	2.90	0.93	2.02	0.74	2.45	281.
	Zinc	tot	2.87	1.79	3.04	3.04	- ∞	2.77	2.36	2.99	2.34	2.98	0.93	2.70	0.39	2.93	844.

•

BACKGROUND SOILS

			משות	DALK BRUUNN SULLS		3		
	B651		8652 8653 8654	8654	١×	S	/m/	until oa
Barium	2.28	21.12	14.8	18.6	2.29	0.00	2.40	6/m 6/ C
Buyllium	-0.55	-6.55	-6.35	-0.5/	-0.49	0.08	-0.40	0.40 29/9
Chromum	11.1	1.12	1.13	1.11	1.12	0.01	1.13	13.49 4
Copper	1.05	1111	1.35	81.1	1.17	0.11	1.30	19.95.4
Load.	0.89	08.0	611	1.02	0.97	D.14	1.13	13.494
"Mickel	1.35	1.56	1.29	1.31	1.38	0.11	1.51	13.36 M
Zinc	1.83	01'6	1.99	1.9.3	1.96	01.0	37.08	120. July
Arsenic	0.45	0.45	0.45	0.45	0.45	0.00	0.45	2.8.2 14
Padmum	-0.46	-0.4c	-0.4%	-0.46	-0.46	000	-0.46	0.35 49
Mercury	-1.30	-1.30	-1.30	087-	-1.30	0.00	-1.30	0.050%
Antimimu	0.10	0.10	0.10	0.10	0.10	0.00	0110	1.26 "19
Silver	-6.49	-0.49	-0.49	-0.49	-0.49	0.00	-0.49	0.32 W
Selenium	6.00	0.03	60.0	0.02	0.02	0.00	0.07	165 W.M.

Background Surface Water Inorganics

9/ M C	2/
Copper	4.63 113/18
W. CKe. l	12.00 11119
Zine	You what
all ciners	11/7

(only one background Sample was collected)

APPENDIX G CHEMICAL DATA

The LCAAP Level Three chemical data will be submitted at a later date as a separate addendum to this RI.

APPENDIX H

TOXICITY SUMMARIES

APPENDIX H TOXICITY SUMMARIES

Antimony

Antimony was detected in the monitoring well within the production well capture zone, Area 1, 2, 4, 5, 8, and 17 groundwater wells, in surface water in the Area 13 drainage ditch, the pond, and Ditch B. and in subsurface soil in Area 15.

Antimony is a metal which occurs both in the trivalent and pentavalent oxidation states (EPA 1980). Absorption of this metal via oral and inhalation routes of exposure is low (EPA 1980). Humans and animals exposed acutely orally or through inhalation to either trivalent or pentavalent forms of antimony displayed electrocardiogram (ECG) changes and myocardial lesions (EPA 1980). Pneumoconiosis has been observed in humans exposed by acute inhalation and dermatitis has occurred in individuals exposed either orally or dermally. Oral administration of therapeutic doses in humans has been associated with nausea, vomiting, and hepatic necrosis (EPA 1980). Chronic exposure by inhalation of antimony has lead to respiratory effects including microphage proliferation and activity, fibrosis and pneumonia in animals (EPA 1980). A single report (Balyeava 1967) noted an increase in spontaneous abortions, premature births, and gynecological problems in 318 female workers exposed to a mixture of antimony metal, antimony trioxide, and antimony pentasulfide dusts.

EPA (1988) derived an oral RfD of 4x10⁻⁴ mg/kg/day for antimony based on a chronic oral study (Schroeder et al. 1970) in which rats given the metal in drinking water had altered blood glucose and blood cholesterol levels and decreased lifespan. By using an uncertainty factor of 1,000, a LOAEL of 0.35 mg/kg/day was used to derive the oral RfD.

Arsenic

Arsenic was detected in groundwater in the production wells, the monitoring well within the production well capture zone, and Area 1, 2, 3, 4, 5, 6, 7, 8, 16, and 17 wells and in surface water in the pond and Ditch B. It was also detected in sediments in the Area 13 and 16 drainage ditches, the Area 16 leachate seep, Ditch B, and the big ditch. In surface soils, arsenic was detected in Area 9 and 13 and in subsurface soils in Area 8, 14, and 15.

Both inorganic and organic forms of arsenic are readily absorbed via the oral and inhalation routes. Soluble forms are more readily absorbed than the insoluble forms (EPA 1984). Approximately 95% of soluble inorganic arsenic administered to rats is absorbed from the gastrointestinal tract (Coulson et al. 1935, Ray-Bettley and O'Shea 1975). Approximately 70%-80% of arsenic deposited in the respiratory tract of humans has been shown to be absorbed (Holland et al. 1959). Dermal absorption is not significant (EPA 1984). Acute exposure of humans to metalic arsenic has been associated with gastrointestinal effects, hemolysis, and neuropathy (EPA 1984). Chronic exposure of humans to this metal can produce toxic effects on both the peripheral and central nervous systems, keratosis, hyperpigmentation. precancerous dermal lesions, and cardiovascular damage (EPA 1984). Arsenic is embryotoxic, fetotoxic, and teratogenic in several animals species (EPA 1984). Arsenic is a known human carcinogen. Epidemiological studies of workers in smelters and in plants manufacturing arsenical pesticides have shown that inhalation of arsenic is strongly associated with lung cancer and perhaps with hepatic angiosarcoma (EPA 1984). Ingestion of arsenic has been linked to a form of skin cancer and more recently to bladder, liver, and lung cancer (Tseng 1977, Tseng et al. 1968, Chen et al. 1986).

EPA has classified arsenic in Group A--Human Carcinogen--and has developed inhalation (EPA 1988a) and (1988b) oral cancer potency factors of 50 (mg/kg/day)⁻¹ and 1.75 (mg/kg/day)⁻¹, respectively. The inhalation potency factor is the geometric mean value of potency factors derived from four

occupational exposure studies on two different exposure populations (EPA 1984). The oral cancer potency factor was based on an epidemiological study in Taiwan which indicated an increased incidence of skin cancer in individuals exposed to arsenic in drinking water (Tseng 1977). EPA (1988b) has reported an oral reference dose (RfD) of 1×10^{-3} mg/kg/day based on the study by Tseng (1977) in which blackfoot disease was observed in humans exposed to arsenic in their drinking water. An uncertainty factor of 1 was used to develop the RfD. The EPA is currently reviewing the oral RfD (EPA 1988a).

Barium

Barium was detected in the monitoring well within the production well capture zone and Area 6 groundwater wells.

Adverse effects in humans following oral exposure to soluble barium compounds include gastroenteritis, muscular paralysis, hypertension, ventricular fibrillation, and central nervous system damage (EPA 1984, Perry et al. 1983). Inhalation of barium sulfate or barium carbonate in occupationally exposed workers has been associated with baritosis, a benign pneumoconiosis (Goyer 1986). Experimental animals exposed chronically to barium in drinking water developed increased blood pressure (EPA 1984). Inhalation of barium carbonate dust by experimental animals has been associated with reduced sperm count, increased fetal mortality, and atresia of the ovarian follicles (EPA 1984 Tarasenko et al. 1977).

EPA (1988) derived an oral reference dose (RfD) based on a chronic rat study in which a lowest-observed-adverse-effect level (LOAEL) for increased blood pressure was observed (Perry et al. 1983). Using the LOAEL of 5.1 mg/kg/day and an uncertainty factor of 100, an oral RfD of 5×10^{-2} mg/kg/day was calculated. EPA (1989) has also developed an inhalation RfD of 1.4×10° mg/kg/day for barium based on a study by Tarasenko et al. (1977). In this study rats were exposed to barium carbonate dust at airborne concentrations of up to 5.2 mg/m³ for 4-6 months. Adverse effects noted at

this concentration included decreased body weight, alterations in liver function, and increased fetal mortality. An uncertainty factor of 1,000 was used in developing the RfD.

Benzene

Benzene was detected in groundwater in the production wells, the monitoring well within the production well capture zone, Area 16, and Area 17. In surface water, it was detected in Area 16 and in the big ditch. It was not detected in sediments or soils.

Benzene is readily absorbed following oral and inhalation exposure (EPA 1985). The toxic effects of benzene in humans and other animals following exposure by inhalation include central nervous system effects, hematological effects, and immune system depression. In humans, acute exposures to high concentrations of benzene vapors has been associated with dizziness, nausea, vomiting, headache, drowsiness, narcosis, coma, and death (NAS 1976). Chronic exposure to benzene vapors can produce reduced leukocyte, platelet, and red blood cell counts (EPA 1985). Benzene induced both solid tumors and leukemias in rats exposed by gavage (Maltoni et al. 1985). Many studies have also described a causal relationship between exposure to benzene by inhalation (either alone or in combination with other chemicals) and leukemia in humans (IARC 1982).

Applying EPA's criteria for evaluating the overall evidence of carcinogenicity to humans, benzene is classified in Group A (Human Carcinogen) based on adequate evidence of carcinogenicity from epidemiological studies. EPA (1988) derived both an oral and an inhalation cancer potency factor for benzene of $2.9 \times 10^{-2} \; (\text{mg/kg/day})^{-1}$. This value was based on several studies in which increased incidences of nonlymphocytic leukemia were observed in humans occupationally exposed to benzene principally by inhalation (Rinsky 1981, Ott 1978, Wong 1983). EPA is currently reviewing an oral RfD for benzene and its status is pending.

Beryllium

Beryllium was detected in all groundwater wells except the residential well and Area 9 through 14 wells. It was also detected in surface water in the Area 16 leachate seep, in sediments in the Area 16 leachate seep and drainage ditch, ditch B, and the big ditch, in Area 9 surface soil, and in Area 8 and 15 subsurface soil.

Beryllium is not readily absorbed by any route of exposure. Occupational exposure to beryllium results in bone, liver and kidney disposition (EPA 1986). In humans, acute respiratory effects due to beryllium exposure include rhinitis, pharyngitis, tracheobronchitis, and acute pneumonitis. Dermal exposure to soluble beryllium compounds can cause contact dermatitis, ulceration and granulomas (Hammond and Beliles 1980). Ocular effects include conjunctivitis and corneal ulceration from splash burns. The most common clinical symptom caused by chronic beryllium exposure is granulomatous lung inflammation (IARC 1980, EPA 1986). Chronic skin lesions sometimes appear after a long latent period in conjunction with the pulmonary effects. Systemic effects from beryllium exposure may include right heart enlargement with accompanying cardiac failure, liver and spleen enlargement, cyanosis, digital clubbing, and kidney stone development (EPA 1986). Beryllium has been shown to be carcinogenic in experimental animals resulting primarily in lung and/or bone tumors when given by injection, intratracheal administration, or inhalation (EPA 1986). Several epidemiological studies have suggested that occupational exposure to beryllium may result in an increased lung cancer risk although the data are inconclusive (EPA 1986).

Beryllium has been classified by EPA in Group B2--Probable Human Carcinogen based on increased incidences of lung cancer and osteosarcomas in animals (EPA 1988). EPA (1988) has calculated an inhalation cancer potency factor of 8.4 (mg/kg/day)⁻¹ based on the relative risk for lung cancer, estimated from an epidemiological study by Wagoner et al. (1980). EPA (1988) has also developed an oral reference dose (RfD) for beryllium of 5.0 x 10⁻³ mg/kg/day based on a

study by Schroeder and Mitchner (1975) in which rats exposed to 0.54 mg/kg/day beryllium sulfate (the highest dose tested) in drinking water for a lifetime did not exhibit adverse effects; an uncertainty factor of 100 was used to develop the RfD.

Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate was detected in all groundwater wells except the production wells, the residential well, and Area 12 wells. It was also detected in surface water samples in Area 16 and in Ditch B.

Bis(2-ethylhexyl)phthalate, also known as di-ethylhexyl phthalate (DEHP), is readily absorbed following oral or inhalation exposure (EPA 1980). Chronic exposure to relatively high concentrations of DEHP in the diet can cause retardation of growth and increased liver and kidney weights in laboratory animals (NTP 1982, EPA 1980). Reduced fetal weight and increased number of resorptions have been observed in rats exposed orally to DEHP (EPA 1980). DEHP is reported to be carcinogenic in rats and mice, causing increased incidences of hepatocellular carcinomas or neoplastic nodules following oral administration (NTP 1982).

DEHP has been classified in Group B2--Probable Human Carcinogen (EPA 1986). EPA (1988) calculated an oral cancer potency factor for DEHP of 1.4x10⁻² (mg/kg/day)⁻¹ based on data from the NTP (1982) study. EPA has recommended an oral reference dose (RfD) for DEHP of 0.02 mg/kg/day based on a study by Carpenter et al. (1953) in which increased liver weight was observed in female guinea pigs exposed to 19 mg/kg bw/day in the diet for 1 year (EPA 1988); an uncertainty factor of 1,000 was used to develop the RfD.

Cadmium

Cadmium was detected in the monitoring well within the production well capture zone, Area 2, 4, 5, 8, 9, 10, 11 and 14 groundwater well, in sediments in the

Area 13 and 16 drainage ditches, ditch B, and the big ditch, in Area 9 surface soils, and in Area 8, 14 and 15 subsurface soils.

Gastrointestinal absorption of cadmium in humans ranges from 5-6% (EPA 1985a). Pulmonary absorption of cadmium in humans is reported to range from 10% to 50% (CDHS 1986). Cadmium bioaccumulates in humans, particularly in the kidney and liver (EPA 1985a,b). Chronic oral or inhalation exposure of humans to cadmium has been associated with renal dysfunction, itai-itai disease (bone damage), hypertension, anemia, endocrine alterations, and immunosuppression. Renal toxicity occurs in humans at a renal cortex concentration of cadmium of 200 ug/g (EPA 1985b). Epidemiological studies have demonstrated a strong association between inhalation exposure to cadmium and cancers of the lungs, kidney, and prostate (EPA 1985b, Thun et al. 1985). In experimental animals, cadmium induces injection-site sarcomas and testicular tumors. When administered by inhalation, cadmium chloride is a potent pulmonary carcinogen in rats. Cadmium is a well-documented animal teratogen (EPA 1985b).

EPA (1988, 1989) classified cadmium as a Group Bl agent (Probable Human Carcinogen) by inhalation. This classification applies to agents for which there is limited evidence of carcinogenicity in humans from epidemiologic studies. EPA (1989) derived an inhalation cancer potency factor of 6.1 (mg/kg/day)⁻¹ for cadmium based on epidemiologic studies in which respiratory tract tumors were observed (Thun et al. 1985, EPA 1985b). Using renal toxicity as an endpoint, and a safety factor of 10, EPA (1980, 1987, 1988) has derived two separate oral reference doses (RfD). The RfD associated with oral exposure to drinking water is 5×10^{-4} mg/kg/day, and is based upon the lowest-observed-adverse-effect level (LOAEL) of 0.005 mg/kg in humans (Friberg et al. 1974). The RfD associated with exposure to cadmium in food or other nonaqueous oral exposures is 1×10^{-3} mg/kg/day.

Carbon Tetrachloride

Carbon tetrachloride (CCl.) is readily absorbed following oral and inhalation exposure. About 60% of an oral dose was absorbed by 6 hours, and up to 86% was absorbed by 24 hours. Absorption from the lung has been estimated at about 30% (EPA 1984). CCl, like many other chlorinated hydrocarbons, acts as a central nervous system depressant (ACGIH 1986). The toxic effects of oral and inhalation exposure to CCl, in humans and animals include damage to the liver, kidney and lung, although the liver is the most sensitive tissue (EPA 1985, Bruckner et al 1986). In animals, acute oral administration produces fatty infiltration and histological alterations in the liver. High doses produce irreversible liver damage and necrosis while the effects observed following lower doses are largely reversible (EPA 1985). Humans occupationally exposed to 5-15 ppm of CCl4 experience biochemical alterations, nausea, headaches and in more severe cases, liver dysfunction (jaundice, enlargement and fatty infiltration) (ACGIH 1986, EPA 1984). Animals chronically exposed to CCl4 exhibit effects similar to those observed following acute exposure. Prenatal toxicity has been demonstrated in mammalian fetuses and neonates after inhalation exposure in pregnant rats (EPA 1984), although CCl4 has not been shown to be teratogenic (EPA 1985). Carbon tetrachloride is a carcinogen in animals producing mainly hepatic neoplasms. Oral administration of 30 mg/kg/day or higher for 6 months have been found to produce an increased frequency of hepatomas, hepatocellular adenomas and hepatocellular carcinomas in mice, rats and hamsters (EPA 1985).

EPA (1988) has classified CCl₄ as a B2 agent (probable human carcinogen). The cancer potency factor for both oral and inhalation exposure is 1.3x10⁻¹ (mg/kg/day)⁻¹. EPA (1988) established the cancer potency factor based on several gavage studies in which hepatocellular carcinomas and hepatomas were observed in rats, mice and hamsters (Della Porta et al. 1961, Edwards et al. 1942, NCI 1976a, 1976b, 1977). EPA (1988) has derived an oral reference dose (RfD) of 7x10⁻⁴ mg/kg/day based on a subchronic rat gavage study in which liver lesions were the most sensitive effect (Bruckner et al. 1986). A no

observed adverse effect level (NOAEL) of 0.71 mg/kg/day and an uncertainty factor of 1,000 were used to derive the RfD.

Carcinogenic PAHs

Carcinogenic PAHs were detected in Area 18 groundwater wells and in sediments at the Area 13 drainage ditch, the Area 16 leachate seep and drainage ditch, the pond and Ditch B.

PAHs occur in the environment as complex mixtures containing numerous PAHs of varying carcinogenic potencies. Only a few components of these mixtures have been adequately characterized, and only limited information is available on the relative potencies of different compounds.

PAH absorption following oral exposure is inferred from the demonstrated toxicity of PAHs following ingestion (EPA 1984a). PAH absorption following inhalation exposure is inferred from the demonstrated toxicity of PAHs following inhalation (EPA 1984a). PAHs are also absorbed following dermal exposure (Kao et al. 1985). It has been suggested that simultaneous exposure to carcinogenic PAHs such as benzo[a]pyrene and particulate matter can increase the effective dose of the compound (ATSDR 1987). Acute effects from direct contact with PAHs and related materials are limited primarily to phototoxicity; the primary effect is dermatitis (NIOSH 1977). PAHs have also been shown to cause cytotoxicity in rapidly proliferating cells throughout the body; the hematopoietic system, lymphoid system, and testes are frequent targets (Santodonato et al. 1981). Destruction of the sebaceous glands, hyperkeratosis, hyperplasia, and ulceration have been observed in mouse skin following dermal application of the carcinogenic PAHs (Santodonato et al. 1981). The carcinogenic PAHs have also been shown to have an immunosuppressive effect in animals (ATSDR 1987). Nonneoplastic lesions are seen in animals exposed to the more potent carcinogenic PAHs only after exposure to levels well above those required to elicit a carcinogenic response. Carcinogenic PAHs are believed to induce tumors both at the site of application and systemically. Neal and Rigdon (1967) reported that oral administration of 250 ppm benzo[a]pyrene for approximately 110 days led to forestomach tumors in mice. Thyssen et al. (1981) observed respiratory tract tumors in hamsters exposed to up to 9.5 mg/m³ benzo[a]pyrene for up to 96 weeks.

Benzo[a]pyrene is representative of the carcinogenic PAHs and is classified by EPA in Group B2--Probable Human Carcinogen--based on sufficient evidence of carcinogenicity from animal studies and inadequate evidence from epidemiological studies (EPA 1984c). EPA (1984a) calculated an oral cancer potency factor of 11.5 (mg/kg/day)⁻¹ for carcinogenic PAHs (specifically benzo[a]pyrene) based on the study by Neal and Rigdon (1967). EPA (1984a) calculated an inhalation cancer potency factor of 6.1 (mg/kg/day)⁻¹ for benzo[a]pyrene based on the study by Thyssen et al. (1981). These potency factors are currently undergoing a reevaluation based on recalculation of the data.

Chlorobenzene

Chlorobenzene was detected in the residential groundwater well.

Evidence from toxicity studies suggests that chlorobenzene is absorbed after oral, inhalation, and dermal exposure (EPA 1985). Acute and chronic exposures to chlorobenzene have been associated in humans and experimental animals with central nervous system (CNS) effects, liver and kidney lesions, and respiratory distress. Results of reproductive studies with rats and dogs also indicate that chlorobenzene induces testicular lesions (EPA 1985).

EPA (1988a,b) derived an oral chronic RfD for chlorobenzene of 3×10^{-2} mg/kg/day based on a study by Monsanto (1967) in which dogs administered chlorobenzene in capsules for 90 days exhibited liver and kidney effects; an uncertainty factor of 1,000 was used to develop the RfD. EPA (1988a,b) also reported an inhalation chronic RfD for chlorobenzene of 5×10^{-3} mg/kg/day based

on a study by Dilley (1977) in which rats exposed to chlorobenzene for 120 days exhibited liver and kidney effects; an uncertainty factor of 10,000 was used to develop the RfD.

Chloroethane

Chloroethane was detected in groundwater in the monitoring well within the production well capture zone and Area 5 wells and in surface water at the Area 16 leachate seep.

Chloroethane is primarily absorbed through the lungs, although some dermal absorption may occur. Absorption and excretion of chloroethane occurs rapidly via the lungs; it is not metabolized to a significant degree (Clayton and Clayton 1981). Severe acute inhalation of chloroethane by humans produces minor neurological effects that are manifested as stupor and lack of coordination, and in some incidences as cardiac arrhythmia produced by the potentiation of adrenalin (Clayton and Clayton 1981). Acute inhalation of chloroethane by animals has produced histological or pathological changes in the liver, brain, and lungs (Troshina 1964). Chronic exposure of animals to chloroethane produced kidney damage and fatty changes in the liver, and at high levels has upset cardiac rhythm (EPA 1985). Studies assessing the mutagenicity and carcinogenicity of chloroethane are currently being conducted (EPA 1985).

Chloroform

Chloroform was detected only in Area 17 groundwater wells.

Chloroform, a trihalomethane, is rapidly absorbed through the respiratory and gastrointestinal tracts in humans and experimental animals; dermal absorption from contact of the skin with liquid chloroform can also occur (EPA 1985). In humans, acute exposures to chloroform may result in depression of the central nervous system, hepatic and renal damage and death caused by ventricular

fibrillation following an acute ingested dose of 10 ml (EPA 1984). Acute exposure to chloroform may also cause irritation to the skin, eyes, and gastrointestinal tract (EPA 1984, 1985). In experimental animals, chronic exposure may lead to fatty cyst formation in the liver (Heywood et al. 1979), renal, and cardiac effects and central nervous system depression (EPA 1985). Chloroform has been reported to induce renal epithelial tumors in rats (Jorgenson et al. 1985) and hepatocellular carcinomas in mice (NCI 1976). Suggestive evidence from human epidemiological studies indicates that long-term exposure to chloroform and other trihalomethanes in contaminated water supplies may be associated with an increased incidence of bladder tumors (EPA 1985).

Chloroform has been classified by EPA as a Group B2 Carcinogen (Probable Human Carcinogen) (EPA 1988). EPA (1988) developed an oral cancer potency factor for chloroform of 6.1x10⁻³ (mg/kg/day)⁻¹ based on a study in which kidney tumors were observed in rats exposed to chloroform in drinking water (Jorgenson et al. 1985). An inhalation cancer potency factor of 8.1x10⁻² (mg/kg/day)⁻¹ has been developed by EPA (1988) based on an NCI (1976) bioassay in which liver tumors were observed in mice. EPA (1988) also derived an oral reference dose (RfD) of 0.01 mg/kg/day for chloroform based on a chronic bioassay in dogs in which liver effects were observed at 12.9 mg/kg/day (Heywood et al. 1979); an uncertainty factor of 1,000 was used to derive the RfD.

Chromium

Chromium was detected in the monitoring well within the production well capture zone, Area 2 through 8, 11, 12, 14, 16 and 17 groundwater wells, and the residential well. It was also detected in surface water in the Area 13 drainage ditch, in sediments in the Area 13 drainage ditch, Ditch A, Ditch B, the big ditch, and the unnamed ditch, and in surface soils in Areas 9 and 13.

Chromium exists in two states, as chromium (III) and as chromium (VI). Following oral exposure, absorption of chromium (III) is low while absorption of chromium (VI) is high (EPA 1987). Chromium is an essential micronutrient and is not toxic in trace quantities (EPA 1980). High levels of soluble chromium (VI) and chromium (III) can produce kidney and liver damage following acute oral exposure; target organs affected by chronic oral exposure remain unidentified (EPA 1984). Chronic inhalation exposure may cause respiratory system damage (EPA 1984). Further, epidemiological studies of worker populations have clearly established that inhaled chromium (VI) is a human carcinogen; the respiratory passages and the lungs are the target organs (Mancuso 1975, EPA 1984). Inhalation of chromium (III) or ingestion of chromium (VI) or (III) has not been associated with carcinogenicity in humans or experimental animals (EPA 1984). Certain chromium salts have been shown to be teratogenic and embryotoxic in mice and hamsters following intravenous or intraperitoneal injection (EPA 1984).

EPA has classified inhaled chromium (VI) in Group A--Probable Human Carcinogen by the inhalation route (EPA 1988b). Inhaled chromium (III) and ingested chromium (III) (EPA 1988a) and (VI) (EPA 1988b) have not been classified with respect to carcinogenicity. EPA (1988b) developed an inhalation cancer potency factor of 41 (mg/kg/day)⁻¹ for chromium (VI) based on an increased incidence of lung cancer in workers exposed to chromium over a 6 year period, and followed for approximately 40 years (Mancuso 1975). EPA (1988b) derived an oral reference dose (RfD) of 5.0x10⁻³ mg/kg/day for chromium (VI) based on a study by MacKenzie et al. (1958) in which no observable adverse effects were observed in rats exposed to 2.4 mg chromium (VI)/kg/day in drinking water for 1 year. A safety factor of 500 was used to derive the RfD. EPA (1988a) developed an oral RfD of 1 mg/kg/day for chromium (III) based on a study in which rats were exposed to chromic oxide baked in bread; no effects due to chromic oxide treatment were observed at any dose level (Ivankovic and Preussman 1975). A safety factor of 1000 was used to calculate the oral RfD.

Copper

Copper was detected in all groundwater wells, in all surface water areas except the unnamed ditch, in all but ditch A, big ditch, and unnamed ditch sediments, in Area 9 surface soils, and in Area 8 and 15 subsurface soils.

Copper is an essential element. A daily copper intake of 2 mg is considered to be adequate for normal health and nutrition; the minimum daily requirement is 10 μ g/kg (EPA 1985). In humans, absorption of copper following oral exposure is approximately 60% and is influenced by competition with other metals and the level of dietary protein and ascorbic acid in both humans and animals (EPA 1984). Copper is absorbed following inhalation exposures, although quantitative data on the extent of absorption are unavailable (EPA 1984). Adverse effects in humans resulting from acute exposure to copper at concentrations that exceed these recommended levels by ingestion include salivation, gastrointestinal irritation, nausea, vomiting, hemorrhagic gastritis, and diarrhea (ACGIH 1986). Dermal or ocular exposure of humans to copper salts can produce irritation (ACGIH 1986). Acute inhalation of dusts or mists of copper salts by humans may produce irritation of the mucous membranes and pharynx, ulceration of the nasal septum, and metal fume fever. The latter condition is characterized by chills, fever, headache, and muscle pain. Limited data are available on the chronic toxicity of copper; however, chronic over-exposure to copper by humans has been associated with anemia (ACGIH 1986) and local gastiointestinal irritation (EPA 1987). Results of several animal bioassays suggest that copper compounds are not carcinogenic by oral administration; however, some copper compounds can induce injection-site tumors in mice (EPA 1985).

EPA (1988) has reported a drinking water standard of 1.3 mg/liter based on local gastrointestinal irritation (EPA 1987). Assuming a 70-kg adult ingests 2 liters of water per day, this concentration is equivalent to a dose of 3.7×10^{-2} mg/kg/day. However, EPA (1987) concluded toxicity data were inadequate for the calculation of a reference dose (RfD) for copper.

Cyanide

Cyanide was detected in surface soils in Area 9.

The toxicity of cyanides is strongly dependent on their chemical speciation. Free cyanides are readily absorbed from the gastrointestinal tract, lungs, and skin and, once absorbed, are rapidly distributed throughout the body (EPA 1985). The toxic effects in humans following acute oral exposure to free cyanides include hyperventilation, vomiting, unconsciousness, convulsions. vascular collapse and cyanosis, and death (EPA 1985). Inhalation of high concentrations of hydrogen cyanide (HCN) gas results in almost immediate collapse, respiratory arrest, and death within minutes (DiPalma 1971). Airborne hydrogen cyanide concentrations between 99 and 528 mg/m³ are fatal within 30-60 minutes (NIOSH 1976). There is limited data on chronic exposures of cyanide in humans, although the following effects have been identified in chronic occupationally exposed workers in some epidemiologic studies: neurological dysfunction, lacrimation, abdominal pain, muscular weakness, and shortness of breath (NIOSH 1976). Cyanide appears to be less toxic to animals following chronic exposures than following acute exposures. In animals, chronic oral exposure has produced weight loss, thyroid effects and myelin degeneration (Howard and Hanzal 1955). Cyanide can cause teratogenic effects when subcutaneously administered to hamsters; this teratogenic effect has not been observed in other species although some reproductive toxicity has been noted (EPA 1985).

EPA (1988, 1989) calculated an oral reference dose (RfD) of 0.02 mg/kg/day for cyanide based on a chronic study by Howard and Hanzal (1955) in which rats were maintained on a diet fumigated with hydrogen cyanide and exhibited weight loss, thyroid effects and myelin degeneration. No observed adverse effects (NOAEL) were noted at the highest dose administered (10.8 mg/kg/day). A NOAEL of 10.8 mg/kg/day and a safety factor of 500 were used to derive the RfD (EPA 1988).

1,2-Dichloroethane

1,2-Dichloroethane.was detected in groundwater in the monitoring well within the production well capture zone and in Area 16 wells.

Data on the toxicokinetics of 1.2-dichloroethane (1.2-DCA) in humans are limited, but data from animal studies suggest that the chemical is rapidly absorbed following oral and inhalation exposure and after dermal contact with the liquid form of the compound (EPA 1985). Effects of acute inhalation exposure in humans include irritation of mucous membranes in the respiratory tract and central nervous system depression (EPA 1985). Death may occur as a result of respiratory and circulatory failure. Pathological examinations typically show congestion, degeneration, necrosis, and hemorrhagic lesions of the respiratory and gastrointestinal tracts, liver, kidney, spleen, and lungs (EPA 1985). Adverse effects caused by less extreme exposures are generally associated with the gastrointestinal and nervous systems. Occupational exposures to 1,2-DCA vapors result in anorexia, nausea, vomiting, fatigue, nervousness, epigastric pain, irritation of the eyes and respiratory tract, and gastrointestinal, liver, and gallbladder disease (EPA 1984, 1985). Chronic studies in animals also have revealed toxic effects following inhalation exposure including degeneration of the liver (EPA 1985). Available data suggest that 1,2-DCA does not adversely affect reproductive or developmental processes in experimental animals except at maternally toxic levels (EPA 1985). In long-term oral bioassays sponsored by the National Cancer Institute (NCI 1978), increased incidences of squamous-cell carcinomas of the forestomach, mammary gland adenocarcinomas, and hemangiosarcomas have been observed in rats exposed to 1,2-DCA; pulmonary adenomas, mammary adenocarcinomas, and uterine endometrial tumors have been observed in mice exposed to this chemical.

EPA (1988) has classified 1,2-DCA in Group B2 (Probable Human Carcinogen) based on inadequate evidence of carcinogenicity from human studies and

sufficient evidence of carcinogenicity from animal studies. EPA (1988) derived an oral and an inhalation cancer potency factor (q_1*) of 9.1×10^{-2} $(mg/kg/day)^{-1}$ for 1,2-DCA based on the incidences of hemangiosarcomas in Osborne-Mendel male rats observed in the NCI (1978) gavage study.

1.1-Dichloroethene

1,1-Dichloroethene was detected in the monitoring well within the production well capture zone, Area 3, 5, 16, and 18 groundwater wells.

1,1-Dichloroethene (1,1-DCE) is rapidly absorbed after oral and inhalation exposures (EPA 1984, 1987). Humans acutely exposed to 1,1-DCE vapors exhibit central nervous system depression. In animals, the liver is the principal target of 1,1-DCE toxicity. Acute exposures result in liver damage which ranges from fatty infiltration to necrosis (EPA 1987). Workers chronically exposed to 1,1-DCE in combination with other vinyl compounds exhibit liver dysfunction, headaches, vision problems, weakness, fatigue and neurological sensory disturbances (EPA 1987). Chronic oral administration of 1,1-DCE to experimental animals results in both hepatic and renal toxicity (EPA 1984). Inhalation or oral exposure of rats and rabbits has produced fetotoxicity and minor skeletal abnormalities, but only at maternally toxic doses. 1,1-DCE vapors produced kidney tumors and leukemia in a single study of mice exposed by inhalation, but the results of other studies were equivocal or negative (EPA 1987, Maltoni et al. 1985).

EPA has classified 1,1-DCE as a Group C agent (Possible Human Carcinogen) and has developed inhalation and oral cancer potency factors of 1.2 (mg/kg/day)⁻¹ and 0.6 (mg/kg/day)⁻¹, respectively (EPA 1985, 1988). The inhalation potency factor was based on the increased incidence of renal adenocarcinomas in male mice exposed to 1,1-DCE via inhalation for 52 weeks and observed for a total of 121 weeks (Maltoni et al. 1985). The oral potency factor was derived by estimating an upper-limit value from negative bioassay data and assuming that a carcinogenic response occurs via ingestion, although there is no direct

evidence that this is true. EPA (1988) developed an oral reference dose (RfD) of 9×10^{-3} mg/kg/day based on the occurrence of hepatic lesions in rats chronically exposed to 1,1-DCE in drinking water (Quast et al. 1983). A safety factor of 1000 was applied to the lowest-observed-adverse-effect level (LOAEL) of 9 mg/kg/day to derive the oral RfD.

trans-1,2-Dichloroethene

trans-1,2-Dichloroethene was detected in the production wells, Area 2, 5, 8, 16, and 17 groundwater wells and in surface water in the Area 16 leachate seep.

trans-1,2-Dichloroethene is expected to be absorbed by any route of exposure. Information on the health effects of trans-1,2-dichloroethene is limited. In humans, trans-1,2-dichloroethene is a central nervous system depressant, and exposure to high concentrations can result in anesthetic effects (Irish 1963). Inhalation exposure of rats to 200 ppm has been associated with pneumonic infiltration of the lungs and progressive fatty degeneration of the liver (Freundt et al. 1977). Acute exposure to higher dose levels can cause narcosis and death in rats (Torkelson and Rowe 1981).

EPA (1985) proposed a maximum contaminant level goal (MCLG) of 70 μ g/liter for both cis- and trans-1,2-dichloroethene based on the adjusted acceptable daily intake (AADI) of 350 μ g/liter, assuming 20% of the exposure is via drinking water. EPA (1988) has derived an oral reference dose (RfD) of 2×10^{-2} mg/kg/day for trans-1,2-dichloroethene based on a 90-day drinking water study conducted in mice (Barnes et al. 1985). A no-observed-adverse-effect level (NOAEL) of 17 mg/kg/day for increased serum alkaline phosphatase and an uncertainty factor of 1,000 were used to derive the RfD.

1.2-Dichloropropane

- 1,2-Dichloropropane was only detected in Area 17 groundwater wells.
- 1,2-Dichloropropane is absorbed following ingestion and inhalation exposure. Adverse effects associated with acute exposure in humans have included CNS depression, narcosis, headache, and mucous membrane irritation. In animals, effects associated with acute exposure have included histopathological changes in the liver, kidney, and adrenals. Altered serum enzyme activities were also reported (EPA 1985). Chronic or subchronic exposure of experimental animals to 1,2-dichloropropane has been associated with reduced body weight, liver necrosis, centrilobular congestion, altered CNS function, and altered serum enzyme activities (EPA 1985). DeLorenzo et al. (1977) reported that 1,2-dichloropropane induced reverse and forward mutations in some test species. The compound also induced sister chromatid exchanges and chromosomal aberrations in Chinese hamster ovary cells in vitro (NTP 1986). 1,2-Dichloropropane caused a dose-related increased incidence of hepatocellular adenomas in rats (NTP 1986).
- 1,2-Dichloropropane is categorized in Group B2--Probable Human Carcinogen (EPA 1989). This chemical has an oral cancer potency factor of 6.8×10^{-2} (mg/kg/day)⁻¹ based on an increased incidence of hepatocellular adenomas in mice in the study conducted by NTP (1986) (EPA 1989).

1.3-DNB

1,3-DNB was detected in the monitoring well within the production well capture zone, Area 4, 6, and 16 groundwater wells.

Absorption of the dinitrobenzene (DNB) isomers (1,2-DNB, 1,3-DNB, and 1,4-DNB) have not been well characterized, however ready absorption through the skin is a major factor in its toxicity (ACGIH 1986). Occupational exposures to the DNB isomers have been associated with methemoglobinemia and respiratory tract

irritation. Prolonged exposures of humans to dinitrobenzene may result in anemia, liver damage and cyanosis (Beard and Noe 1981). In animals, subchronic oral exposures have resulted in retarded growth, decreased hemoglobin concentrations, splenic enlargement and hemosiderin deposits. Testicular atrophy and decreased spermatogenesis have also been observed in male rats following oral exposures (Cody et al. 1981).

EPA 1988 has developed an oral reference dose (RfD) of 1.0x10⁻⁴ mg/kg/day for 1,3-DNB based on a subchronic drinking water study in rats. This study identified a lowest-observed-effect-level (LOEL) of 8 ppm for increased splenic weight and a no-observed-effect-level (NOAEL) of 3 ppm (0.40 mg/kg/day) (Cody et al. 1981). The RfD was calculated using the NOAEL and an uncertainty factor of 3000.

2.4 and 2.6 - Dinitrotoluene

Both 2,4-DNT and 2,6-DNT were detected in the monitoring well within the production well capture zone and in Area 17 groundwater wells. 2,4-DNT was also detected in Area sediments in Ditch A. 2,6-DNT was also detected in Area 2 groundwater wells and in Area 8 subsurface soils.

Dinitrotoluene (DNT) is rapidly absorbed following inhalation, dermal and oral exposure, and once absorbed, is distributed throughout the body. DNT undergoes oxidative and reductive metabolism with the primary sites of metabolic activity in the liver and small intestine (Schut et al. 1982). The blood, liver, and neuromuscular systems are the primary target organs for DNT toxicity in both humans and experimental animals. In humans, symptoms resulting from subchronic and chronic exposures to DNT include cyanosis, dizziness, headaches, dyspnea and brown urine (Etnier 1987). Long term occupational exposures also have been correlated with an increase in ischemic heart disease (Levine et al. 1986). In rats, chronic exposure to mixtures of 2,4- and 2,6-DNT in the diet has been reported to significantly increase the incidence of liver tumors (Ellis et al. 1979). Bioassays using the individual

isomers indicate that most of the carcinogenicity of 2,4-DNT/2,6-DNT mixtures can be attributed to the 2,6-isomer, and that pure 2,4-DNT is not carcinogenic (Leonard et al. 1987). These data are not conclusive, however.

EPA (1988) reported an oral potency factor for 2,4-DNT of 0.68 (mg/kg/day)⁻¹. Etnier (1987) developed an oral potency factor of 4.83 (mg/kg/day)⁻¹ for 2,6-DNT. The potency factor for 2,4-DNT was derived based on the study of Ellis et al. (1979) in which progressive development of hepatocellular carcinomas was reported in male and female Charles River CD rats following exposure doses of 35 and 45 mg/kg/day, respectively, for more than a year. The potency factor for 2,6-DNT was derived using the data of Leonard et al. (1987) which indicated a statistically significant increase in the incidence of hepatocarcinomas in male Fischer 344 rats fed 7 and 14 mg/kg/day pure 2,6-DNT for 1 year.

Di-n-butyl phthalate

Di-n-butyl phthalate was detected only in sediments in the Area 16 drainage ditch.

Di-n-butyl phthalate is readily absorbed following oral and inhalation exposure (EPA 1980). Acute exposures of di-n-butyl phthalate aerosol in mice have produced irritation of the eyes and upper respiratory tract mucous membranes. Extreme exposures result in labored breathing, ataxia, paresis, convulsions and death from paralysis of the respiratory system (ACGIH 1986). Workers chronically exposed to di-n-butyl phthalate in combination with other phthalate plasticizers have exhibited pain, numbness and spasms in the upper and lower extremities. Further evaluation revealed vestibular dysfunction and polyneuritis (ACGIH 1986). Reduced fetal weight, increased numbers of resorptions, and dose-related musculoskeletal abnormalities have been observed among fetuses from rats and mice exposed to very high doses of di-n-butyl phthalate during gestation (Shiota and Nishimura 1982).

EPA (1988) calculated an oral reference dose (RfD) for di-n-butyl phthalate based on a study by Smith (1953) in which male Sprague-Dawley rats were fed a diet containing dibutyl phthalate for a period of 1 year. One-half of all rats receiving the highest dibutyl phthalate concentration (1.25% of diet, or 600 mg/kg/day) died during the first week of exposure. The remaining animals survived the study with no apparent adverse effects. Using a NOAEL of 125 mg/kg/day (0.25% dibutyl phthalate in diet) and an uncertainty factor of 1,000, an oral reference dose (RfD) of 0.1 mg/kg/day was derived; a LOAEL of 600 mg/kg/day (1.25% dibutyl phthalate in diet) was observed in this study.

Di-n-octvl phthalate

Di-n-octyl phthalate was detected in the monitoring well within the production well capture zone, Area 1, 10, and 16 groundwater wells.

Di-n-octyl phthalate is not especially toxic. It is a severe eye and a mild skin irritant in rabbits (NIOSH 1985, NTP/IRLG 1982, EPA 1980). Fetotoxicity and developmental abnormalities were observed in the offspring of rats administered 5 g/kg intraperitoneal injections on days 6 to 15 of gestation (NTP/IRLG 1982, EPA 1980).

Ethylbenzene

Ethylbenzene was detected in Area 17 groundwater wells and in surface water in the Area 16 leachate seep.

Ethylbenzene is absorbed via inhalation and distributed throughout the body in rats; the highest levels were detected in the kidney, lung, adipose tissue, digestive tract, and liver (Chin et al. 1980). In humans, short-term inhalation exposure to 435 mg/m³ ethylbenzene for 8 hours can result in sleepiness, fatigue, headache, and mild eye and respiratory irritation (Bardodej and Bardodejova 1970); eye irritation has also been observed in experimental animals exposed to ethylbenzene (EPA 1987). Increased weights

and cloudy swelling were observed in the liver and kidney of rats exposed to ethylbenzene by stomach tube at a dose of 408 mg/kg/day for 182 days (Wolf et al. 1956). A single oral dose of ethylbenzene administered by stomach tube to male and female Wistar-derived rats was reported to have an LD_{50} of 3,500 mg/kg body weight, with systemic effects occurring primarily in the liver and kidney (Wolf et al. 1956). Maternal toxicity was observed in rats exposed by inhalation to 4,348 mg/m³ ethylbenzene for 6-7 hours/day during the first 19 days of gestation (Hardin et al. 1981).

EPA (1988) derived an oral reference dose of 0.1 mg/kg/day for ethylbenzene based on the chronic study by Wolf et al. (1956) in which no liver or kidney effects were observed in rats exposed to 136 mg/kg/day. An uncertainty factor of 1,000 was applied to the no-observed-effect-level to derive the reference dose.

HMX

HMX was detected in the monitoring well within the production well capture zone, Area 3, 4, 6, 7, 11, 12, 17 and 18 groundwater wells and in surface water in Ditch A.

HMX is absorbed to a very limited extent following oral exposure. In rats and mice, between 70 and 85% of the administered dose was eliminated in the feces within 4 days (Cameron 1986). No data were found in the available literature regarding pulmonary or dermal absorption.

EPA (1988) developed an RfD based on a subchronic study in which groups of 20 male and 20 female Fischer 344 rats received HMX in the diet for 13 weeks (Everett et al. 1985). Dietary concentrations corresponded to dosages of 0, 50, 150, 450, 1350 and 4000 mg/kg bw for males and 0, 50, 115, 270, 620 and 1500 mg/kg bw for the emales. Histopathologic changes were observed in the liver of males at the three highest dose levels, and in the kidneys of females in the three highest dose groups, indicating sexual differences in the target

organ responses of rats. Based on these results, lowest-observed-adverse-effect levels (LOAEL) of 150 and 270 mg/kg/day and no-observed-adverse-effect levels (NOAEL) of 50 and 115 mg/kg/day were identified for males and females, respectively. The RfD of 0.05 mg/kg/day was derived by applying an uncertainty factor of 1000 to the NOAEL for males.

Lead

Lead was detected in groundwater in all areas except the residential wells, in surface water in Area 13 and 16 drainage ditches, the Area 16 leachate seep, and ditch B, in sediments in all areas sampled, in Area 9 and 13 surface soils, and in Area 8 and 15 subsurface soils.

Absorption of lead from the gastrointestinal tract of humans is estimated at 10%-15%. For adult humans, the deposition rate of particulate airborne lead is 30%-50%, and essentially all of the lead deposited is absorbed. Lead is stored in the body in the kidney, liver and bone (EPA 1984). The major adverse effects in humans caused by lead include alterations in the hematopoietic and nervous systems. The toxic effects are generally related to the concentration of this metal in blood. Blood concentration levels of over 80 μ g/dl in children and over 100 μ g/dl in sensitive adults can cause severe. irreversible brain damage, encephalopathy, and possible death. Lower blood concentrations of lead (30-40 $\mu g/dl$) have been associated in humans with altered nerve conduction, altered testicular function, renal dysfunction, and anemia. Lead exposure also has been associated in humans with spontaneous abortions, premature delivery, and early membrane rupture in humans; however, reliable exposure estimates are lacking in these cases. Decreased fertility, fetotoxic effects, and skeletal malformations have been observed in experimental animals exposed to lead (EPA 1984). Chronic oral ingestion of certain lead salts (lead acetate, lead phosphate, lead subacetate) has been associated in experimental animals with increased renal tumors. Doses of lead that induced kidney tumors were high and were beyond the lethal dose in humans (EPA 1985).

EPA classified certain lead salts in Group B2--Probable Human Carcinogen (EPA 1985), although no cancer potency factor has been established (EPA 1988). This category applies to those agents for which there is sufficient evidence of carcinogenicity in animals and inadequate evidence of carcinogenicity in humans. EPA (1985) has noted that the available data provide an insufficient basis on which to regulate lead acetate, phosphate and subacetate as human carcinogens. EPA (1988) has also considered it inappropriate to develop a reference dose (RfD) for inorganic lead and lead compounds, since many of the health effects associated with lead intake occur essentially without a threshold.

Mercury

Mercury was detected in the Area 13 drainage ditch surface waters and sediments, in ditch B sediments, in Area 9 surface soils, and in Area 8 and 9 subsurface soils.

In humans, inorganic mercury is absorbed following inhalation and oral exposure, however only 7% to 15% of administered inorganic mercury is absorbed following oral exposure (EPA 1984, Rahola et al. 1971. Task Group on Metal Accumulation 1973). Organic mercury is almost completely absorbed from the gastrointestinal tract and is assumed to be well absorbed via inhalation in humans (EPA 1984). A primary target organ for inorganic compounds is the kidney. Acute and chronic exposures of humans to inorganic mercury compounds have been associated with anuria, polyuria, proteinuria, and renal lesions (Hammond and Beliles 1980). Chronic occupational exposure of workers to elemental mercury vapors (0.1 to 0.2 mg/m³) has been associated with mental disturbances, tremors, and gingivitis (EPA 1984). Animals exposed to inorganic mercury for 12 weeks have exhibited proteinuria, nephrotic syndrome and renal disease (Druet et al. 1978). Rats chronically administered inorganic mercury (as mercuric acetate) in their diet have exhibited decreased body weights and significantly increased kidney weights (Fitzhugh et al.

1950). The central nervous system is a major target for organic mercury compounds. Adverse effects in humans, resulting from subchronic and chronic oral exposures to organic mercury compounds have included destruction of cortical cerebral neurons, damage to Purkinje cells, and lesions of the cerebellum. Clinical symptoms following exposure to organic mercury compounds have included paresthesia, loss of sensation in extremities, ataxia, and hearing and visual impairment (WHO 1976). Embryotoxic and teratogenic effects, including malformations of the skeletal and genitourinary systems. have been observed in animals exposed orally to organic mercury (EPA 1984). Both organic and inorganic compounds are reported to be genotoxic in eukaryotic systems (Leonard et al. 1984).

EPA (1989) has reported an oral RfD for methyl mercury of 3×10^{-4} mg/kg/day based on studies investigating central nervous system effects in humans exposed to mercury (EPA 1980); an uncertainty factor of 10 was used to develop the RfD. EPA (1989) has also reported an oral reference dose of 3×10^{-4} mg/kg/day for inorganic mercury based on a chronic rat study in which kidney effects were observed (Fitzhugh et al. 1950). An uncertainty factor of 1,000 was used to derive the RfD.

Methylene chloride

Methylene chloride was detected in Area 5, 7, and 17 groundwater wells.

Methylene chloride is absorbed following oral and inhalation exposure. The amount of airborne methylene chloride absorbed following inhalation exposure increases in direct proportion to its concentration in inspired air, the duration of exposure, and physical activity. Dermal absorption has not been accurately measured (EPA 1988). Acute human exposure to methylene chloride may result in irritation of eyes, skin, and respiratory tract; central nervous system depression; elevated carboxyhemoglobin levels; and circulatory disorders that may be fatal. Chronic exposure of animals can produce renal and hepatic toxicity (EPA 1988). Methylene chloride is mutagenic for

Salmonella typhimurium and produces mitotic recombination in yeast (EPA 1988). Several inhalation studies conducted in animals provide clear evidence of methylene chloride's carcinogenicity. There is only suggestive evidence in experimental animals that hepatocellular carcinomas and neoplastic nodules arise from oral exposure (F2A 1985a,b).

EPA (1989) classified methylene chloride in Group B2--Probable Human Carcinogen. It has been concluded by EPA (1985b) that the induction of distant site tumors from inhalation exposure and the borderline significance for induction of tumors in a drinking water study are an adequate basis for concluding that methylene chloride be considered a probable human carcinogen via ingestion as well as inhalation. EPA (1989) derived an inhalation cancer potency factor of $1.4 \times 10^{-2} \text{ (mg/kg/day)}^{-1}$ based on the results of a National Toxicology Program (NTP) inhalation bioassay conducted in rats and mice (NTP 1986). Mammary tumors were noted in rats, while lung and liver tumors were observed in mice.. EPA (1988) determined an oral cancer potency factor of 7.5×10^{-3} (mg/kg/d₃y)⁻¹ based on the results of the NTP (1986) inhalation bioassay and on an ingestion bioassay conducted by the National Coffee Association (NCA 1983). In the NCA study, hepatocellular adenomas and/or carcinomas were observed in male mice. An oral reference dose (RfD) of 0.06 mg/kg/day has been developed by EPA (1989) based on a 2-year rat drinking water bioassay (NCA 1982) that identified no-observed-effect levels (NOELs) of 5.85 and 6.47 mg/kg/day for male and female rats, respectively. Liver toxicity was observed at doses of 52.58 and 58.32 mg/kg/day for males and females, respectively. An uncertainty factor of 100 was used to derive the RfD.

Nickel

Nickel was detected in all areas where groundwater leachate seep and drainage ditch, ditches A and B, and the big ditch, and in sediments in the Area 13 drainage ditch and the big ditch.

Nickel compounds can be absorbed following inhalation, ingestion, or dermal exposure. The amount absorbed depends on the dose administered and the chemical and physical form of the particular nickel compound (EPA 1986). Dermal exposure of humans to nickel produces allergic contact dermatitis (EPA 1986). Adverse effects associated with acute exposure in animals have included depressed weight gain, altered hematological parameters, and increased iron deposition in blood, heart, liver, and testes (EPA 1987). Chronic or subchronic exposure of experimental animals to nickel has been associated with reduced weight gain, degenerative lesions of the male reproductive tract, asthma, nasal septal perforations, rhinitis, sinusitis, hyperglycemia, decreased prolactin levels, decreased iodine uptake, and vasoconstriction of the coronary vessels (EPA 1986). Teratogenic and fetotoxic effects have been observed in the offspring of exposed animals (EPA 1986). Inhalation exposure of experimental animals to nickel carbonyl or nickel subsulfide induces pulmonary tumors (EPA 1986). Several nickel salts cause localized tumors when administered by subcutaneous injection or implantation. Epidemiological evidence indicates that inhalation of nickel refinery dust and nickel subsulfide is associated with cancers of the nasal cavity, lung, larynx, kidney, and prostate (EPA 1986).

Nickel refinery dust and nickel subsulfide are both categorized in Group A--Human Carcinogens. These classifications are based on an increase incidence of lung and nasal tumors observed in workers occupationally exposed to nickel refinery dust. These materials have inhalation cancer potency factors of 0.84 (mg/kg/day)⁻¹ and 1.7 (mg/kg/day)⁻¹, respectively (EPA 1988). Nickel carbonyl is categorized in Group B2--Probable Human Carcinogen; however, a potency factor has not been derived for nickel carbonyl (EPA 1988). EPA (1988) derived an oral reference dose (RfD) for nickel of 2x10⁻² mg/kg/day based on a study by Ambrose et al. (1976) in which rats administered 5 mg/kg/day (NOAEL) nickel in the diet for 2 years did not experience decreased weight gain observed in animals administered 50 mg/k/gday (LOAEL). A safety factor of 300 was used to calculate the RfD.

Nitrobenzene

Nitrobenzene was detected only in Area 16 groundwater wells.

Nitrobenzene is absorbed by all possible routes, but absorption primarily occurs through the respiratory tract and skin (EPA 1980); approximately 80% of inhaled nitrobenzene is absorbed (EPA 1980). In humans long-term occupational exposure to nitrobenzene can result in cyanosis, methemoglobinemia, jaundice, anemia, sulfhemoglobinemia, and dark urine (EPA 1980). Short-term exposure to high levels of nitrobenzene can result in cyanosis, and if severe, the individual can go into a coma (Piotrowski 1967). Hematologic, adrenal, renal, and hepatic lesions have been reported in rats and mice exposed to nitrobenzene in air for 90 days (CIIT 1984). There is also limited evidence that exposure to nitrobenzene can result in changes in the tissues of the chorion and placenta in pregnant women (Dorigan and Hushon 1976); menstrual disturbances after chronic nitrobenzene exposure have also been reported (EPA 1980).

EPA (1988a) developed an inhalation RfD for nitrobenzene of 6x10⁻⁴ mg/kg/day based on a study in which hematological, adrenal, renal, and hepatic lesions were observed in mice following inhalation exposure to nitrobenzene (CIIT 1984) and using an uncertainty factor of 10,000. EPA (1988b) also developed an oral RfD for nitrobenzene of 5x10⁻⁴ mg/kg/day based on the CIIT study based on route-to-route extrapolation and using an uncertainty factor of 10,000 (EPA 1988).

N-nitrosodiphenylamine

N-nitrosodiphenylamine was detected in the monitoring well within the production well capture zone, Area 8 and 12 groundwater wells.

N-Nitrosodiphenylamine (NDPA) is absorbed following ingestion. In rats NDPA can cross the placenta (EPA 1980). Its acute oral toxicity in rats is very

low (Druckrey et al. 1967). In subchronic feeding studies conducted in rats, weight reduction was reported. Trace amounts of pigmentation were observed in hepatic Kupffer cells of male mice (NCI 1979). When NDPA was administered to rats late in pregnancy, neoplasms were induced in the offspring (EPA 1980). Significant increases in the incidence of urinary bladder carcinomas in male and female rats were reported. A dose related trend in fibromas of the subcutis and skin among male rats was also observed (NCI 1979).

NDPA by ingestion is categorized in Group B2--Probable Human Carcinogen. This compound has an oral cancer potency factor of 4.9×10^{-3} (mg/kg/day)⁻¹ (EPA 1988). This value was based on an increased incidence of bladder tumors in male and female rats (NCI 1979).

Noncarcinogenic PAHs

Noncarcinogenic PAHs were detected in Area 1 groundwater wells and in sediments in the Area 13 drainage ditch, the Area 16 drainage ditch, the pond and Ditch B.

Polycyclic aromatic hydrocarbons (PAHs) occur in the environment as complex mixtures of which only a few components have been adequately characterized. Only limited information is available on the relative potencies of the "noncarcinogenic" PAHs. However, many have been shown to have some weak carcinogenic activity, or to act as promoters or cocarcinogens.

PAH absorption following oral and inhalation exposure is inferred from the demonstrated toxicity of PAHs following these routes of administration (EPA 1984a). PAHs are also absorbed following dermal exposure (Kao et al. 1985). Acute effects from direct contact with PAHs and related materials are limited primarily to phototoxicity; the primary effect is dermatitis (NIOSH 1977). PAHs have also been shown to cause cytotoxicity in rapidly proliferating cells throughout the body; the hematopoietic system, lymphoid system, and testes are frequent targets (Santodonato et al. 1981). Some of the noncarcinogenic PAHs

have been shown to cause systemic toxicity but these effects are generally seen at high doses (Santodonato et al. 1981). Slight morphological changes in the liver and kidney of rats have been reported following oral exposure to acenaphthene for 40 days (EPA 1984a). Subchronic oral administration of naphthalene to rabbits and rats has resulted in cataract formation (EPA 1984b). EPA (1988) developed an oral reference dose of 0.4 mg/kg/day for naphthalene based on the development of ocular and systemic lesions in rats (Schmahl 1955, EPA 1986) and occupational data on coke oven workers. An uncertainty factor of 100 was applied to the animal data in the development of the reference dose.

Phenol

Phenol was detected only in surface water in the Area 16 leachate seep.

Phenol is readily absorbed through the gut, by inhalation, and percutaneously (EPA 1980). Signs of acute phenol toxicity in humans and experimental animals are central nervous system depression, collapse, coma, cardiac arrest, and death. Acutely toxic doses can also cause extensive necrosis at the site of exposure (eyes, skin, oropharynx) (EPA 1980). In experimental animals subchronic oral and inhalation studies suggest that kidney, pulmonary, myocardial, and liver damage are associated with exposure, although many of these studies were poorly designed (EPA 1980, 1984). Phenol exhibited tumor-promoting activity in the mouse skin painting system following initiation with 9,10-dimethyl-1,2-benzanthracene (DMBA) or benzo[a]pyrene (B[a]P), and it exhibited cutaneous carcinogenic activity in a sensitive mouse strain when applied at concentrations that produced repeated skin damage (EPA 1980).

The oral RfD calculated by EPA (1988) has been withdrawn and is pending further review. An inhalation acceptable intake chronic (AIC) of 1.4 mg/person/day (0.02 mg/kg/day) was recommended by EPA (1984) based on the threshold limit value of 19 mg/m³ phenol established by the American

Conference of Governmental Industrial Hygienists (ACGIH 1983). EPA has not yet established an inhalation RfD (EPA 1988).

<u>RDX</u>

RDX was detected in all groundwater wells except the production wells and the residential well.

RDX is slowly absorbed in humans and laboratory animals following oral and inhalation exposures (Etnier 1986). No data are available regarding dermal absorption, but because RDX is relatively lipid insoluble, skin absorption is unlikely (Rosenblatt 1980). In humans, the toxic effects of RDX have been on the central nervous system (CNS). Chronic exposures in humans have been associated with generalized convulsions and unconsciousness, followed by temporary amnesia and disorientation (Stokinger et al. 1982). In animals, hepatotoxicity, anemia, and testicular and urogenital lesions have been reported following chronic exposures, in addition to CNS effects (Levine et al. 1983).

No conclusive evidence of carcinogenicity has been shown for RDX. RDX was not found to be carcinogenic in Fisher 344 rats (Levine et al. 1983) or Sparague-Dawley rats (Hart 1977) exposed to RDX in the diet for 2 years. However, Lish et al. (1984) reported a statistically significant increase in the combined incidence of hepatocellular carcinomas and adenomas in female B6C3F1 mice fed RDX in the diet for two years.

EPA (1988) derived a reference dose (RfD) of 0.003 mg/kg/day for RDX based on a chronic study in which male and female Fischer rats received RDX in the diet for 24 months at dosages of 0, 0.3, 1.5, 8.0, or 40 mg/kg bw/day (Levine et al. 1983). Rats in the three highest dose groups experienced statistically significant increases in mortality, anemia with secondary splenic lesions, hepatotoxicity, cataracts, and urogenital lesions. A lowest-observed-adverse-effect level (LOEAL) of 1.5 mg/kg/day was identified based on suppurative

inflammation of the prostate. The no-observed-adverse-effect-level (NOAEL) was 0.3 mg/kg/day.

EPA (1989) has classified RDX in Group C -- possible human carcinogen and has developed an oral potency factor of 0.11 (mg/kg/day)⁻¹. The potency factor was based on the increased incidence of combined hepatocellular carcinomas and adenomas in female mice receiving RDX in the diet for two years at doses of 7, 35 or 100 mg/kg.

Selenium

Selenium was detected in the monitoring well within the production well capture zone. Areas 1, 2, and 7 groundwater wells, in ditch B surface waters, and in Area 9 surface soils.

Results of studies with humans and experimental animals indicate that certain selenium compounds are readily absorbed from the gastrointestinal tract following oral exposure (EPA 1984). The pulmonary absorption of selenium following inhalation exposure has not been well studied, although there are reports suggesting that selenium is absorbed to some extent by this route (EPA 1984). Selenium is an essential element and therefore is nontoxic at doses necessary for normal health and nutrition. NAS (1980) reported that an adequate and safe selenium intake for an adult human ranges from 0.05 mg/day to 0.2 mg/day. However, exposure to selenium at levels that exceed these standards has been associated with adverse health effects. Such effects observed in experimental animals following subchronic or chronic oral exposure to various selenium compounds have included anemia, reduced growth, increased mortality, and lesions of the liver, heart, kidney, and spleen (EPA 1984). In humans, chronic oral exposure to selenium has been associated with alopecia, dermatitis, discoloration of the skin, loss of fingernails, muscular dysfunction, convulsions, paralysis, and increased incidences of dental caries (EPA 1984). Headaches and respiratory irritation have been noted in humans following acute inhalation exposure (EPA 1984). Studies with a variety of

animals have suggested that selenium may be teratogenic; however, these studies are limited in that exposure levels are not well characterized (EPA 1984).

Oral and inhalation reference doses (RfD) of 3.0×10^{-3} mg/kg/day and 1.0×10^{-3} mg/kg/day, respectively, have been derived by EPA (1984, 1988). The oral RfD value was based on a study by Yang et al. (1983) in which humans exposed to selenium in the diet at doses of 3.2 mg/day developed loss of hair, loss of fingernails, dermatitis, and muscular dysfunction. By applying an uncertainty factor of 15 and a LOAEL of 3.2 mg/day, EPA (1984) determined the oral RfD value of 3×10^{-3} mg/kg/day. The oral RfD is currently under review by the oral RfD Work Group at EPA (1988). The inhalation RfD value was based on an occupational study by Glover (1967) in which workers exposed to airborne concentrations of selenium developed dermatitis and gastrointestinal disturbances. An uncertainty factor of 10 was used to determine the inhalation RfD (EPA 1988).

Silver

Silver was detected in all areas except Area 14 and the residential well. It was also detected in surface waters in the Area 16 leachate seep.

Silver in various forms is absorbed to a limited extent following oral and inhalation exposures (EPA 1985). The acute toxic effects in humans following oral exposure to silver include corrosive damage to the GI tract leading to shock, convulsions, and death. In animals, acute exposure has been shown to affect the central nervous system and to cause respiratory paralysis (Hill and Pillsbury 1939). The primary effect of silver in humans following chronic exposures, is argyria, a permanent bluish-metallic discoloration of the skin and mucous membranes, which can be either localized or generalized. Silver also accumulates in the blood vessels and connective tissue (EPA 1985).

EPA (1988) derived an oral reference dose (RfD) of 3.0x10⁻³ mg/kg/day for silver based on the human case reports of Gaul and Staud (1935). Blumberg and Carey (1934), and East et al. (1980). In these studies, argyria was observed at an average dose of silver of 0.0052 mg/kg/day, to which an uncertainty factor of 2 was applied.

<u>Tetrachloroethene</u>

Tetrachloroethene was detected in the monitoring well within the production well capture zone, Area 7, 16, and 17 wells, and the residential well. It was also seen in surface water in the Area 16 leachate seep. Tetryl was detected in the monitoring well capture zone and Area 12 and 17 groundwater wells.

Tetryl

Tetryl was detected in the monitoring well within the production well capture zone and Area 12 and 17 groundwater wells.

Information on the toxicity of tetryl is sparse. It has been shown to be mutagenic in DNA repair assays (McGregor et al. 1980). In occupational situations it has been shown to be a skin sensitizer following air exposures and a TLV of 1.5 mg/m3 has been recommended for tetryl (ACGIH 1988). An oral reference dose can be derived from the TLVs by assuming complete absorption of a chemical by both inhalation and ingestion, an inhalation volume of 10 m³ per eight-hour work day, and a 5 day work week. In addition, a safety factor of 100 is applied to the TLV to account for sensitive members of the population and for the use of an exposure level that is higher than a no-effect level in deriving the RfD. (See Layton et al. 1986 for a more complete discussion of this methodology.) Using this approach, an RfD of 0.0015 mg/kg/day is derived.

Toluene

Toluene was detected in Area 17 groundwater wells and the residential well and in surface water in the Area 16 leachate seep.

Toluene is absorbed in humans following both inhalation and dermal exposure (EPA 1985). In humans, the primary acute effects of toluene vapor are central nervous system (CNS) depression and narcosis. These effects occur at concentrations of $^{\circ}$ 200 ppm (754 mg/m³) (von Oettingen et al. 1942a,b). In experimental animals, acute oral and inhalation exposures to toluene can result in central nervous system (CNS) depression and lesions of the lungs, liver, and kidnevs (EPA 1987). The earliest observable sign of acute oral toxicity in animals is depression of the CNS, which becomes evident at approximately 2,000 mg/kg (Kimura et al. 1971). In humans, chronic exposure to toluene vapors at concentrations of approximately 200 and 800 ppm has been associated with CNS and peripheral nervous system effects, hepatomegaly, and hepatic and renal function changes (EPA 1987). Toxic effects following prolonged exposure of experimental animals to toluene are similar to those seen following acute exposure (Hanninen et al. 1976, von Oettingen et al. 1942a). A dose-related reduction in hematocrit values was observed in rats chronically exposed to toluene (CIIT 1980). There is some evidence in mice that oral exposure to greater than 0.3 ml/kg toluene during gestation results in embryotoxicity (Nawrot and Staples 1979). Inhalation exposure of up to 1,000 mg/m³ by pregnant rats during gestation has been associated with significant increases in skeletal retardation (Hudak and Ungvary 1978).

EPA (1988a) has derived an oral risk reference dose (RfD) of 0.3 mg/kg/day for toluene based on a 24-month inhalation study in which rats were exposed to concentrations as high as 300 ppm (29 mg/kg/day) and hematological parameters were examined (CIIT 1980). No adverse effects were observed in any of the treated animals. Using a no-observed-adverse-effect level (NOAEL) of 29 mg/kg/day and an uncertainty factor of 100, the oral RfD was derived. EPA

(1988b) reported an inhalation RfD for toluene of 1.0 mg/kg/day also based on this CIIT study in which CNS effects were noted and an uncertainty factor of 100 was used.

1,1,1-Trichloroethane

1,1,1-Trichloroethane was detected in Area 1, 5, and 17 groundwater wells.

Like other chlorinated aliphatic hydrocarbons, 1,1,1-trichloroethane (1,1,1-TCA, methyl chloroform) is rapidly and completely absorbed following both the oral and inhalation exposure. Pulmonary absorption is initially large and gradually decreases to a steady-state condition. Absorption through the skin is slow. 1,1,1-TCA distributes throughout the body and readily crosses the blood-brain barrier (EPA 1984). The most notable toxic effects of 1,1,1-TCA inhalation exposure in humans and animals are central nervous system depression, including anesthesia at very high concentrations, and impairment of coordination, equilibrium, and judgment at lower concentrations (350 ppm and above). In both humans and animals, cardiovascular effects, including premature ventricular contractions, decreased blood pressure, and sensitization to epinephrine-induced arrhythmia can result from acute exposure to high concentrations of 1,1,1-TCA vapor (EPA 1985). Fatty liver changes have been reported in guinea pigs following subchronic inhalation exposure (Torkelson et al. 1958). NTP (1984) reported preliminary results of bioassays in rats and mice indicating that oral administration of 1,1,1-TCA increases the incidence of hepatocellular carcinomas in female mice but not for male rats. This study was inadequate to evaluate the carcinogenicity of 1,1,1-TCA in female rats and male mice.

EPA (1988a) calculated an oral reference dose (RfD) for 1,1,1-trichloroethane based on an inhalation study by Torkelson et al. (1958) in which rats, rabbits, guinea pigs and monkeys were exposed to 1,1,1-TCA vapor. A no-observed-adverse-effect (NOAEL) of 500 ppm (2,730 mg/m 3 , or 90 mg/kg/day) was identified from this study. Using the NOAEL of 90 mg/kg/day and an

uncertainty factor of 1,000, a RfD of 9x10⁻² mg/kg/day was derived. An inhalation RfD of 0.3 mg/kg/day for 1,1,1-TCA also has been determined by EPA (1988b) based on this same study, in which hepatotoxicity was observed in guinea pigs. An uncertainty factor of 1,000 was used in calculating the RfD.

1,1,2-Trichloethane

1,1,2-Trichloroethane was detected in Area 16 and 17 groundwater wells.

1,1,2-Trichloroethane (1,1,2-TCA) is rapidly absorbed from oral, inhalation and dermal exposures (Torkelson and Rowe 1981, Arena 1979). In humans, acute oral and inhalation exposures to 1,1,2-TCA result in central nervous system (CNS) depression, equilibrium disturbances, vertigo, headaches, lassitude, hypotension, anesthesia and coma (Arena 1979). Acute oral and inhalation administration to animals produces liver and kidney damage, irritation to the eyes and nose, CNS depression, and death due to respiratory arrest (ACGIH 1986, Torkelson and Rowe 1981). In dogs the hepatotoxic effects include hepatocyte vacuolation, enzyme induction, fatty degeneration and necrosis (NRC 1977, Torkelson and Rowe 1981). The hepatoxicity and nephrotoxicity of 1,1,2-TCA has been found to be potentiated by pretreatment with certain halogenated organic compounds and solvents. Dermal exposures result in irritation and injury to the skin from defatation (Torkelson and Rowe 1981). Evidence suggests that 1,1,2-TCA is embryo toxic to chicken eggs (Elovaara 1979). 1,1,2-TCA was found to be weakly mutagenic in S. Cerevisiae (Torkelson and Rowe 1981). Oral administration of 1,1,2-TCA has been associated with the induction of hepatocellular carcinomas and pheochromocytomas in mice but not in rats (NCI 1978, Weisburger 1977)

EPA has classified 1,1,2-TCA in group C (Possible Human Carcinogen). This category applies to agents for which there is limited evidence of carcinogenicty in animals. EPA (1988) has derived a cancer potency factor of 5.7×10^{-2} (mg/kg/day)⁻¹ for both oral and inhalation exposures based on an increased incidence of liver tumors in mice (NCI 1978). EPA (1988) has also

established an oral reference dose (RfD) of 4.0×10^{-3} mg/kg/day for 1,1,2-TCA based upon clinical chemistry alterations in mice given 3.9 mg/kg/day in drinking water. (White et al 1985, Sanders et al 1985). An uncertainty factor of 1.000 was used to calculate the RfD.

Trichloroethene

Trichloroethene was detected in groundwater in the production wells, the monitoring well within the production well capture zone and Area 5, 8, 16, and 17 wells. It was also detected in surface water in the Area 16 leachate seep and the big ditch.

Absorption of trichloroethene (TCE) from the gastrointestinal tract is virtually complete. Absorption following inhalation exposure is proportional to concentration and duration of exposure (EPA 1985). TCE is a central nervous system depressant following acute and chronic exposures. In humans, single oral doses of 15 to 25 ml (21 to 35 grams) of TCE have resulted in vomiting and abdominal pain, followed by transient unconsciousness (Stephens 1945). High-level exposure can result in death due to respiratory and cardiac failure (EPA 1985). Hepatotoxicity has been reported in human and animal studies following acute exposure to TCE (EPA 1985). Nephrotoxicity has been observed in animals following acute exposure to TCE vapors (ACGIH 1986, Torkelson and Rowe 1981). Subacute inhalation exposures of mice have resulted in transient trichloroethene-induced increased liver weights (Kjellstrand et al. 1983). Industrial use of TCE is often associated with adverse dermatological effects including reddening and skin burns on contact with the liquid form, and dermatitis resulting from vapors. These effects are usually the result of contact with concentrated solvent, however, and no effects have been reported after exposure to TCE in dilute, aqueous solutions (EPA 1985). Trichloroethene has caused significant increases in the incidence of hepatocellular carcinomas in mice (NCI 1976) and renal tubular-cell neoplasms in rats exposed by gavage (NTP 1983), and pulmonary adenocarcinomas in mice following inhalation exposure (Fukuda et al. 1983). Trichloroethene was

mutagenic in Salmonella typhimurium and in E. coli (strain K-12), utilizing liver microsomes for activation (Greim et al. 1977).

EPA (1988) classified trichloroethene in Group B2--Probable Human Carcinogin based on inadequate evidence in humans and sufficient evidence of carcinogenicity from animals studies. EPA (1988) derived an oral cancer potency factor of 1.1×10^{-2} (mg/kg/day)⁻¹ and an inhalation cancer potency factor of 4.6×10^{-3} (mg/kg/day)⁻¹ based on the mouse liver tumor data in the NCI (1976) and NTP (1983) gavage studies. EPA (1987) developed an oral reference dose (RfD) of 7.35×10^{-3} mg/kg/day based on a subchronic inhalation study in rats in which elevated liver weights were observed following exposure to 55 ppm, 5 days/week for 14 weeks (Kimmerle and Eben 1973). A safety factor of 1,000 was used to calculate the RfD. However, this RfD is currently under review by EPA.

1,3,5-TNB

1,3,5-TNB was detected in the monitoring well within the production well capture zone, Area 4, 7, 9, 12, and 17 groundwater wells and in surface water in the Area 13 drainage ditch and the Area 16 leachate seep.

Information on the toxicity of 1,3,5-trinitrobenzene is sparse. It has been shown to be mutagenic in DNA repair assays (McGregor et al. 1980). Acute oral toxicity also has been demonstrated with LD₅₀ values of 572 mg/kg, 450 mg/kg, and 730 mg/kg being reported for mice, rats and guinea pigs, respectively (EPA 1987). Quantitative information on nonlethal effects in humans and animals is lacking. However, exposure in humans has been associated with methemoglobia, cyanosis, headache, nausea and other effects. An oral RfD of 0.0025 mg/kg/day is derived by applying a conversion factor of 5x10-6 to the oral RfD of 450 mg/kg, as recommended by Layton et al. (1986).

Vinyl chloride

Vinyl chloride was detected in groundwater in the production wells, the monitoring wells within the production well capture zone, and Area 5 and 16 wells.

Vinyl chloride is rapidly absorbed in rats following oral and inhalation exposure, while dermal absorption of vinyl chloride is minor (EPA 1985). At high inhalation exposure levels, workers have experienced dizziness, headaches, euphoria, and narcosis. In experimental animals, inhalation exposure to high levels of vinyl chloride can induce narcosis and death. Lower doses result in ataxia, narcosis, congestion and edema of the lungs, and hyperemia in the liver (EPA 1985). Chronic inhalation exposure of workers to vinyl chloride is associated with hepatotoxicity, central nervous system disturbances, pulmonary insufficiency, cardiovascular toxicity, gastrointestinal toxicity, and acro-osteolysis (EPA 1985). Experimental animals chronically exposed via inhalation or ingestion have exhibited effects involving the liver, spleen, kidneys, hematopoietic system, and skeletal system (EPA 1984). Feron et al. (1975) found that administration of vinyl chloride to rats by gavage resulted in hematologic, biochemical, and organ-weight effects at doses above 30 mg/kg/day. Evidence for an association between human exposure to vinyl chloride and birth defects or fetal loss is conflicting (EPA 1987). Human exposure to vinyl chloride has been associated with an increased incidence of hepatic angiosarcoma and brain, lung, and hemolymphopoietic cancers. In animal studies, chronic inhalation and ingestion of vinyl chloride at levels as low as 1.7 and 5~mg/kg/day have induced cancer in the liver and in other tissues of rats and mice (IARC 1979; Feron et al. 1981; Maltoni et al. 1980, 1981).

EPA (1988) has classified vinyl chloride in Group A (Human Carcinogen) based on adequate evidence of carcinogenicity from epidemiological studies.

EPA (1988) reported an oral cancer potency factor (q_1^*) of 2.3 $(mg/kg/day)^{-1}$ for vinyl chloride based on the long-term ingestion study in rats in which lung tumors were observed (Feron et al. 1981). The inhalation cancer potency factor for vinyl chloride is 2.95×10^{-1} $(mg/kg/day)^{-1}$ (EPA 1988) and is based on a chronic inhalation studies conducted by Maltoni et al. (1980, 1981) in which liver tumors were observed in rats.

Zinc

Zinc was detected in groundwater in all areas except Area 3, in surface water in Area 16 leachate seep and drainage ditch, ditch A, ditch B, and the big ditch, in sediments in Area 13 drainage ditch and ditch B, in Area 9 surface soils, and in Area 8 and 9 subsurface soils.

Zinc is absorbed in humans following oral exposure; however, insufficient data are available to evaluate absorption following inhalation exposure (EPA 1984). Zinc is an essential trace element that is necessary for normal health and metabolism and therefore is nontoxic in trace quantities (Hammond and Beliles 1980). However exposure to zinc at concentrations that exceed recommended levels has been associated with a variety of adverse effects. Chronic and subchronic inhalation exposure of humans to zinc has been associated with gastrointestinal disturbances, dermatitis, and metal fume fever, a condition characterized by fever, chills, coughing, dyspnea, and muscle pain (EPA 1984). Chronic oral exposure of humans to zinc may cause anemia and altered hematological parameters. Reduced body weights have been observed in studies in which rats were administered zinc in the diet. There is no evidence that zinc is teratogenic or carcinogenic (EPA 1984).

EPA (1988) has derived an oral reference dose (RfD) of 2×10^{-1} mg/kg/day based on studies in which anemia and reduced blood copper were observed in humans exposed to oral zinc doses of 2.14 mg/kg/day (Pories et al. 1967. Prasad et al. 1975). A safety factor of 10 was used in developing the RfD.

APPENDIX I

LIST OF COMMON AND SCIENTIFIC NAMES OF WILDLIFE SPECIES AT LCAAP

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LIST OF COMMON AND SCIENTIFIC NAMES OF WILDLIFE SPECIES AT LCAAP

Common Name

Scientific Name

Birds

Canada goose wood duck bobwhite quail wild turkey woodcock mourning dove Cooper's hawk red-shouldered hawk red-tailed hawk sharp-shinned hawk kestrel barn owl screech owl great horned owl common flicker downy woodpecker red-bellied woodpecker red-headed woodpecker common raven common crow fish crow blue jay loggerhead shrike eastern meadowlark robin Carolina wren American goldfinch horned lark tufted titmouse white-breasted nuthatch

Branta canadensis Aix sponsa Colinus virginianus Meleagris gallopavo silvestris Philohela minor Zenaidura macroura Accipiter cooperii Buteo lineatus Buteo jamaicensis Accipiter striatus Falco sparverius Tyto alba Otus asio Bubo virginianus Colaptes auratus Dendrocopos pubescens Centurus carolinus Melanerpes erythrocephalus Corvus corax Corvus brachyrhynchos Corvus ossifragus Cyanocitta cristata Lanius ludovicianus Sturnella magna Turdus migratorius Thryothorus ludovicianus Spinus tristis Eremophila alpestris Parus bicolor Sitta carolinensis

APPENDIX I

LIST OF COMMON AND SCIENTIFIC NAMES OF WILDLIFE SPECIES AT LCAAP (Continued)

Common Name

Scientific Name

<u>Mammals</u>

coyote
white-tailed deer
gray fox
red fox
muskrat
opossum
eastern cottontail rabbit
raccoon
striped skunk

Canis latrans
Odocoileus virginianus
Urocyon cinereoargenteus
Vulpes fulva
Ondatra zibethicus
Didelphis virginiana
Sylvilagus aquaticus
Procyon lotor
Mephitis mephitis
Sciurus niger

Fish

largemouth bass bluegill green sunfish channel catfish blue catfish golden shiner

fox squirrels

Micropterus salmoides
Lepomis macrochirus
Lepomis cyanellus
Ictalurus punctatus
Ictalurus furcatus
Notropis crysoleucas